

**THE IMPORTANCE OF RESEARCH COLLECTIONS  
OF TERRESTRIAL ARTHROPODS**

A brief prepared by the Biological Survey of Canada  
(Terrestrial Arthropods)

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## **THE IMPORTANCE OF RESEARCH COLLECTIONS OF TERRESTRIAL ARTHROPODS**

### **Abstract**

Terrestrial and freshwater ecosystems of the world include millions of species of insects and arachnids, most of them still unknown to science. Inability to identify these arthropod species is a severe impediment for scientific investigation of terrestrial and freshwater ecosystems; therefore, some of the most critical gaps in biological science occur in the systematics of terrestrial arthropods. Underlying this deficiency in biological science in Canada is inadequate and declining funding for research collections of terrestrial arthropods and their associated curatorial programs. These collections are an irreplaceable scientific resource. They are the source of much that is known about the systematics of insects and mites of Canada, and the base for what has still to be learned; and they are part of the ecological database of the country which is essential for detecting and correcting man-made perturbations of natural biological systems. These collections represent a major part of Canada's participation in the task of documenting the biota of the world.

Recommendations are made to address the declining state of research collections of terrestrial arthropods in Canada, culminating in a proposal for a national plan to improve the infrastructure of all biological research collections, administered by the Canadian Museum of Nature and funded through a specified supplement to the annual budget of the Museum.

## **Importance des collections de recherche d'arthropodes terrestres**

### **Résumé**

Les écosystèmes terrestres et d'eaux douces du monde renferment des millions d'espèces d'insectes et d'arachnides, pour la plupart encore inconnues de la science. L'incapacité d'identifier les espèces d'arthropodes constitue un sérieux obstacle à l'étude scientifique des écosystèmes terrestres et d'eaux douces; par conséquent, la systématique des arthropodes terrestres présente certaines des plus graves lacunes qui soient en biologie. L'insuffisance de fonds et l'érosion des collections de recherche d'arthropodes terrestres ainsi que des travaux de conservation associés sont des problèmes sous-jacents à cette situation au Canada. Ces collections constituent une ressource scientifique irremplaçable. Sources d'une grande partie de nos connaissances sur la systématique des insectes et des acariens du Canada, elles offrent une base pour l'avancement de notre savoir dans le domaine; de plus, elles font partie de la banque de données écologiques du pays, données essentielles pour découvrir et pour corriger les perturbations effectuées par les humains dans les systèmes naturels. Ces collections représentent une part importante de la participation canadienne à la tâche visant à documenter les organismes vivant du monde entier.

Ce mémoire offre des recommandations visant à améliorer la situation des collections de recherche sur les arthropodes terrestres du Canada et, en particulier, à établir un plan national pour l'amélioration des collections de recherche en biologie, lequel serait administré par le Musée canadien de la nature et financé grâce à des fonds supplémentaires affectés à cette fin au Musée.



## Introduction

This brief on the importance of research collections of insects, arachnids, and other terrestrial arthropods to biological science in Canada argues that the collections are part of the fundamental database of the country; and that the current declining state of funding for these collections is unworkable and therefore unacceptable for biological science. Financial support continues to fall behind the cost of maintaining the collections because administrators in governments and universities, confronted with growing demands on their limited budgets, attach low priority to biological research collections.

Insects and other terrestrial arthropods are the dominant animals in terrestrial and freshwater ecosystems.

Research collections underlie the scientific study of insects and other terrestrial arthropods. These collections are the record of the natural diversity, and therefore of the natural heritage, of a country. The enormous diversity of insects, mites, and related arthropods is largely unappreciated, as is the elementary state of scientific understanding about them. Despite their small size, insects and other terrestrial arthropods are the dominant animals in terrestrial and freshwater ecosystems. Even in developed countries, scientific study of these organisms has been neglected, with the result that knowledge about most of the species and their biological interactions is scarcely more than elementary. In Canada, some 32,000 species of insects and mites are known, but recent figures (Danks 1979) indicate that a similar number remain as yet unrecognized, many of them still undescribed and unnamed. Moreover, the larval stages even of the species known to occur in Canada are still largely unidentifiable, a serious deficiency because larvae are usually responsible for the biological impact of the species. Consequently, scientific study of the ecological interactions of insects and mites in Canada is severely hampered by inadequate knowledge of the fauna.

In the growing environmental crisis that confronts society at all levels and in all countries, the concerns of this brief underlie critical biological problems. The growing need to understand how ecosystems function now far exceeds the elementary knowledge that science has accumulated. For these reasons, this brief addresses a serious deficiency in science in Canada.

## Why are terrestrial arthropods important?

Insects, arachnids, and other terrestrial arthropods are important because together they comprise at least 75 per cent of the one million species of animals in the world now known to science. Estimates of the actual number of insects and related forms now living range from 3 million (Wilson 1989) to 30 million (Erwin 1983); therefore, whatever the total, a great deal of fundamental scientific work remains to be done.

The dominance of insects and arachnids among the world's animals is a fundamental scientific insight, yet one not widely appreciated. This dominance means that in numbers of species beyond our comprehension these animals permeate diverse and essential natural processes in Earth's terrestrial and freshwater ecosystems, contributing to the function of the natural world as a self-sustaining biological system (e.g. Wiggins 1983).

The importance of insects and arachnids on this planet is not reckoned solely on the destructive competition of relatively few species in agriculture or forestry or other activities of humans, even though these include problems of great importance. A more essential consideration is their diverse and fundamental involvement in biological support systems — consumption and degradation of organic materials living and dead, predation and parasitism on other insects and animals, biogeochemical cycling,

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pollination of flowers for fruit and seed production, and movement of energy through trophic networks involving multitudes of other species. Evolving over some 400 million years, terrestrial arthropods have come to occupy these

niches on Earth; and the resultant interconnected biological support systems are the foundation for the continued existence of much of life on this planet. Simply put, terrestrial and freshwater ecosystems would not work without insects and arachnids.

Scientific investigation of these essential natural processes is severely hampered because a very large proportion of the arthropod species involved cannot be identified, and hence precise knowledge of the processes cannot be obtained. A world-wide deficiency in studies on the biology of soil-dwelling insects and arachnids is one striking example (Marshall et al. 1982); lack of precision in studies on the ecology of freshwater communities is another (Resh and Unzicker 1975; Schindler 1989).

Other sectors of biology concerned with problems confronting humans also suffer from the inability of science to identify the arthropod species involved. Problems arising, for example, from insecticidal chemicals in agriculture and forestry — resistance, toxic residues, and harmful effects on beneficial species — demand advances in biological control and integrated pest management as never before (Dahlsten 1983). The environmental fine-tuning required in pest management depends on accurate identification in all stages of development of the species involved in a system, knowledge which in turn requires adequate taxonomy (Evans 1973). Costly errors in biological control programs have been caused by erroneous information on identity of species (e.g. Danks 1988). Large untapped potential for classical biological control of pest species still exists, but the screening and selection of appropriate parasites and predators from various parts of the world will make new demands on taxonomy that far exceed current levels of knowledge (Caltagirone 1981; Kim 1980). Debilitating diseases transmitted by arthropods still cause severe problems for humans and livestock in many countries. Recognition of



vector species and of populational differences in their efficacy, information wholly dependent on precise identification of the species involved, is often critical for control of these diseases.

Insects and arachnids are an integral and complex part of the terrestrial and freshwater ecosystems with which the future of humans is inextricably linked; therefore knowledge about the ecological relationships of these animals is a practical necessity.

### **The nature of collections**

Research collections of terrestrial arthropods are staging grounds for the advance of scientific understanding of the species occurring in a region. Specimens in an institutional research collection are assembled over the years by a succession

Identification is the key to unlocking the information available on each species.

of curators and collectors, in a process that requires persistence and insight. The specimens must be carefully prepared and preserved, labelled with

relevant field data, sorted as far as current knowledge and time allow, and maintained in a permanent, museum-type institution. In this way, specimens become available, and progressively more valuable, for scientific study. Without this process of accumulation over many years, species previously unrecognized or little known would never become defined and identifiable entities, and much of our knowledge of their geographic range and ecological significance would never be assembled. This is a basic function of the research collection.

When specimens documented with basic field data are authoritatively identified by expert systematists, they become reference points for research detailing the systematics, geographic distribution, and biology of particular species. The specimens also become references for identifying other specimens submitted from investigations in agriculture, forestry, public health, environmental issues, and also from educators

or the public. Identification is the key to unlocking the information available in the scientific literature on each species throughout the world, and is greatly facilitated by comparison with specimens of confirmed identity in research

Collections of terrestrial arthropods are irreplaceable sources of scientific information.

collections. Institutional research collections benefit from many individual contributors, growing to become more significant with the passage of time; and as habitats are modified, early collections provide useful benchmarks in documenting changing communities. For all of these reasons, well-established institutional collections of terrestrial arthropods are irreplaceable sources of scientific information (e.g. Kim 1975; Knutson 1978).

## The nature of systematics

To serve the need for science to comprehend the biological world, one of the tasks of systematics is to establish a taxonomic foundation of named species, distinguishable one from another and classified in a system of hierarchic categories that permit communication and generalization about them. This basis for communication in biology is the elementary objective of systematics.

Research in systematics involves the study of virtually all available specimens of a taxonomic group in order to ensure comprehensive treatment, and is dependent on the availability of well curated collections. In the course of these studies, species previously unrecognized are frequently discovered. A single holotype specimen

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designated for each species is the standard of definition for that species. Much of research in biology is ultimately dependent on the scientific names of the species; the stability of those names depends on the existence of type specimens which serve to resolve

any question as to what species each name refers. It is essential that type specimens be maintained in collections that can guarantee their permanent security. Systematic biology, which could not proceed without collections, can be fairly described as the foundation upon which the rest of biology stands, and as the science of biological diversity.

Because different species can differ in important biological attributes, and researchers sometimes make mistaken identification through error or inadequate systematic support, it is important that anyone publishing research on insect species deposits voucher specimens in a permanent collection. If there is any future doubt about the identity of the specimens upon which published work is based, voucher specimens are essential to ascertain just what species was used in the research (e.g. Francoeur 1976; Yoshimoto 1978). For example, what was considered a common, variable species of cutworm moths a few years ago is now known to be four different species (Franclemont 1980). Early papers supposedly dealing with one species might actually deal with any of the four, and would be rendered valueless unless supported by voucher specimens for subsequent confirmation.

The importance of the systematics of terrestrial arthropods rests solidly on the necessity to understand how ecosystems function, and what organisms are involved in particular biological processes. For that understanding, the species must be known. Similar justification could be made for most other groups of animals and plants; but the vast numbers of insects and arachnids in the world's terrestrial and freshwater biotas (see above), coupled with the primitive state of knowledge about them, confirm that within the systematics of arthropods are some of the most critical gaps in biological science (e.g. Evans 1968; Wilson 1971, 1985). Moreover, the immature stages of insects are usually the most crucial in biological impact, but the taxonomy of larval stages lags far behind that of adults. The conclusion is inescapable that the



systematics of terrestrial arthropods is confronted with an unfinished task of enormous size and fundamental importance. Progress with that unfinished task is not possible without strong research collections.

Enhancing man's ability to deal with biological problems through precise identification of the species involved is by no means the only gain from research in the systematics of terrestrial arthropods. There are other important contributions, for systematics is also concerned with integration of the characteristics of organisms into an understanding of the underlying evolutionary relationships and processes through which they came to be (e.g. Mayr 1968). Classifications reflecting these phylogenetic relationships are another contribution of systematics to biology. Systematics is global in scope, and functions as no other sector of biology to synthesize growing bodies of comparative data for generalization and prediction about all animals and plants. Wherever evolutionary history is relevant to a problem, systematics provides the resources. Necessarily, then, systematics is at the leading edge of the study of evolutionary biology; and its central position is assured because new contributions of molecular and genetic research to understanding the evolution of species have to be related to the broader systematic concepts of the taxa concerned.

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Interpretation in biogeography depends substantially on an understanding of evolutionary history, and consequently is closely allied to systematics; the basic data for biogeographic analysis are derived from specimens in collections. As some studies have demonstrated, e.g. Brundin (1966) on Chironomidae, global systematic work on insects has a great deal to contribute to the understanding of evolutionary and geological events in the distant past.

Although they have a fossil record less known than that of vertebrates, arthropods bring an important asset to the study of evolution; the vast numbers of living species in taxa of extraordinary age and diversity suggest that many phylogenetic relicts are still extant as living fossils (e.g. Kristensen 1984; Wiggins 1984). These species are crucial in importance, for they enlarge our understanding of phylogenetic relationships, and enhance the information content of classifications; some represent the missing links sought by evolutionary theorists (e.g. Walker 1937).

The tragedy now in full view is that perhaps one quarter of the earth's plant and animal diversity will become extinct over the next few decades, mainly through destruction of natural habitats by humans (Raven 1990). Several million species of insects and other terrestrial arthropods will be lost forever, and with them the information that might substantially illuminate evolutionary history. The only practical recourse now is an accelerated program of taxonomic inventory of arthropods in threatened areas; but these initiatives are feasible only from the base of established research collections where long-term curation of the collections is assured.



We cannot know now all of the conceptual advances that will be furthered by a working knowledge of the millions of species of insects and their relatives. Yet, to comprehend the biological complexity of this planet is as much a part of our humanity as any other intellectual pursuit.

### **Value of collections in environmental studies**

If biological diversity can be likened to the interwoven fabric of the ecosystems supporting all living things, species are the threads maintaining the integrity of the fabric. Concern for the loss of biological diversity, weakening that fabric, is a large part of the growing anxiety about the natural environment. Yet for insects and other terrestrial arthropods, by far the largest component of that diversity, our knowledge is little

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better than elementary and in many cases even less. It is scarcely conceivable that the science of what life exists on Earth should be in the elementary state that it is when the consequences of continued erosion of biodiversity and biological support systems include massive extinctions and severe degradation of the quality of human life (e.g. Brown et al. 1984). Yet, that is indeed the state of the world.

Recognizing that insects and arachnids are the dominant and most diverse component of terrestrial and freshwater ecosystems, it follows that perturbations in those systems can first be detected by change in the community structure of their species. This is the basis for the practice of ecological monitoring, for example by sampling the benthic insect faunas of rivers and lakes; and insects are an important source of data for environmental impact assessment (e.g. Rosenberg et al. 1986). However, these procedures are effective only to the extent that the species can be identified (e.g. Resh and Unzicker 1975; Lehmkuhl et al. 1984); but in Canada, as in most other parts of the world, identification of many species of insects and arachnids is difficult with existing scientific literature, and identification of their larval stages to species is largely impossible (e.g. Kosztarab and Schaefer 1990).

Research collections of terrestrial arthropods are relevant to this problem in two ways: an increase in the necessary taxonomic database depends on the resources of collections for specimens and related field information; and interpretation of the significance of new samples requires comparison with an antecedent base-line from comparable communities — historical information for which regional collections are the most likely sources (Danks et al. 1987). Because of this crucial contribution to the investigation of environmental damage and climate change, support for research collections of insects and arachnids would be justifiable on environmental issues alone.

Research collections make a crucial contribution to the investigation of environmental damage and climate change.

## **Value of collections in education**

Research collections of insects and other terrestrial arthropods also fulfil an essential educational role at a number of levels. Collections associated with universities are particularly important because they are used in teaching both undergraduate and graduate students. Most entomologists fortunate enough to have been educated at a university with a major insect collection will attribute much of their familiarity with insect diversity and identification to their exposure to that collection. Collections are training grounds for the postgraduate study of future biologists; only through direct involvement by studying and curating good collections do they gain appreciation of the enormous diversity of the natural world. Moreover, the educational value of insect collections goes beyond the important, day-to-day use of collections in university teaching; insect collections are used for museum displays, school tours, extension services, and educational television. Another role of increasing importance for collections of identified specimens of at least the more common species of insects and other terrestrial arthropods is in encouraging naturalists to become more interested in this traditionally neglected part of the fauna.

## **Research collections of terrestrial arthropods in Canada**

Collections of terrestrial arthropods are the data banks for basic systematic knowledge about these organisms. The collections are not anachronisms, as is widely believed, but unique and highly significant scientific and cultural resources. Their present holdings are irreplaceable, and their capacity for acquisition and processing important new data is unique.

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There are in Canada a dozen or so collections of terrestrial arthropods with holdings exceeding 100,000 specimens. The Canadian National Collection in Ottawa, maintained by the Biosystematics Research Centre of Agriculture Canada, is by far the largest; and with about 15 million specimens, it is one of the world's major collections of terrestrial arthropods. Significant museum collections are maintained by the Royal British Columbia Provincial Museum, Victoria; the Provincial Museum of Alberta, Edmonton; the Royal Ontario Museum, Toronto; the Canadian Museum of Nature, Ottawa; and the Nova Scotia Museum, Halifax. There are important collections at universities in Canada: Spencer Entomological Museum, Department of Zoology, University of British Columbia; Strickland Museum, Department of Entomology, University of Alberta; Department of Entomology, University of Manitoba; Department of Environmental Biology, University of Guelph; Lyman Entomological Museum of Macdonald College, McGill University; and Département des Sciences Pures, Université du Québec à Chicoutimi. Individually, these collections and the entomologists responsible for them contribute to the research and educational programs of their institutions. Collectively, the holdings in these collections constitute nearly the entire scientific database on the terrestrial arthropod



fauna of Canada — and not only the existing database, but also the capacity to acquire, process, and preserve new data on the Canadian fauna. Moreover, because Canadian systematists have actively undertaken field work and research in many areas outside Canada, the collections also house substantial bodies of data on the terrestrial arthropod fauna of other countries.

Location of these collections across the country is an effective basis for a system of regional collections in Canada — a concept set out in the Pilot Study for a Biological Survey of the Insects of Canada (Downes 1977) and elsewhere (Danks 1983). Serving as repositories for specimens from sampling programs and faunal studies, regional collections become aggregation points of significant data for taxon-based systematic studies.

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Regional collections can also serve as benchmark references for environmental studies and in public education.

There is a second tier comprising collections of insects and other terrestrial arthropods in Canada with holdings of fewer than 100,000 specimens (Biological Survey of Canada 1978). Although, in total, these collections represent a significant body of primary data on insects and other terrestrial arthropods in Canada, individually they may have an uncertain future because they are less central to the primary objectives of the institutions maintaining them; and some of them are private collections. Some policy is needed in Canada to encourage transfer of these collections to regional centres when they are no longer required by their present custodians.

Some portion of the funds awarded by the Natural Sciences and Engineering Research Council for support of biological research by university personnel in Canada is used for field collecting and study of the systematics of various taxa of terrestrial arthropods. At the conclusion of the recipients' research these collections do not always remain in Canada, despite the recommendation in the NSERC Awards Guide that they should be deposited ultimately in a Canadian institution providing long-term curatorial protection.

Institutions maintaining research collections of insects and other terrestrial arthropods in Canada hold a part of the database of biological science for the country. Public funds directed to these collections and to their supporting activities are responsible investments toward understanding and ultimately protecting biological diversity (e.g. Steere et al. 1971). These collections comprise an irreplaceable scientific resource, growing in importance with new concerns about global change and the loss of biodiversity. To ensure their protection and the perpetuation of their role, the collections and their curatorial activities require a higher level of financial support than they have received in recent years.

## **Responsibility for research collections in Canada**

This brief addresses the issue of inadequate funding for research collections of terrestrial arthropods as a significant part of the scientific database in Canada. A statement on the significance of all biological collections to science in the country was submitted to the Secretary of State by the Biological Council of Canada (1977). Both submissions represent concerns of professional societies for important aspects of their science. The condition of biological research collections is symptomatic of the current deterioration of systematic biology in Canada and elsewhere. This is a serious paradox at a time when the world is facing a crisis in the decline of biodiversity, needing as never before research to document and better understand the biota of the planet.

The root of the problem in Canada is that no agency of government is concerned with the future of biological collections.

The root of this problem in Canada is that no agency of government is concerned with the future of biological collections for the country as a whole. In the United States, the National Science Foundation (NSF) supports research in science, including systematics, but also makes substantial grants for improving collection facilities in museums and universities. The Natural Sciences and Engineering Research Council of Canada (NSERC), analagous in some respects to NSF, has no comparable programs for the support of systematics collections; in part, this is because the mandate of NSERC is interpreted to apply only to research in universities. While NSERC undertakes to be informed about the health and future growth of all sectors of biological science in Canada by soliciting annual reports from its grant selection committees, there is little evidence in NSERC for concern about the country's research collections in the biological sciences even for universities; nor is there much concern about the declining state of systematic biology in Canadian universities.

This brief from the Biological Survey of Canada seeks to bridge the gap by proposing that a national plan be implemented for the disbursement of public funds to support a network of biological research collections in Canada. Justification for this proposal relating to insects and other terrestrial arthropods is given in the preceding parts of this brief, but all biological research collections maintained by public institutions in Canada are in need of similar assistance.

Administration of such a national plan seems best placed with a federal agency that has already within its mandate the support of regional museums throughout Canada — the Canadian Museum of Nature. Funding required for supplementary support of biological research collections would have to be determined and added specifically for that purpose to the annual budget of the Museum of Nature; grants could be recommended by a small independent committee upon assessment of detailed proposals from regional institutions.



## Recommendations

In recognition of the issues considered in this brief, the Biological Survey of Canada (Terrestrial Arthropods) makes the following recommendations to sectors of government, both national and provincial, and to universities, where public funds are assigned in support of science in Canada.

1. Research collections of terrestrial arthropods and the associated curatorial programs are a significant part of the scientific and cultural resources of Canada at both provincial and national levels. These collections and programs represent Canada's participation in the task of documenting the biota of the world, essential for a better understanding of natural ecosystems. Therefore it is critically important that financial support for the collections be maintained, and where necessary increased, as responsible investments of public funds.
2. Documented collections of insects and other terrestrial arthropods that can no longer be maintained by the institutions or individuals currently responsible for them should be recognized as significant scientific assets, and directed to a museum or similar institution in Canada whose mandate it is to maintain research collections.
3. Officials responsible for scientific and environmental programs within each provincial government of Canada should ensure that a functioning regional repository receives documented field collections of insects and other terrestrial arthropods acquired in biological investigations supported by public funds. In many cases, this repository will be the provincial museum; and appropriate steps should be taken to ensure that the museum is adequately equipped and financed to meet the obligations of long-term curation of the collections.
4. Universities in Canada maintaining institutional research and teaching collections of terrestrial arthropods should recognize that these collections and their associated curation are an integral part of advanced scholarship, and warrant funding appropriate to their requirements. Advanced study in the systematics of terrestrial arthropods is severely impaired without these collections. The significance of the collections is similar to that of a library, and more particularly to an archive of irreplaceable scientific data.
5. In applications for research support to the Natural Sciences and Engineering Research Council of Canada, funds requested for the acquisition and maintenance of collections of terrestrial arthropods involved in the study should be accepted as legitimate expenses required in the research. But as a condition of support for those collections, compliance with the NSERC guidelines for awards should be required, i.e. "...Such collections, and type material of new taxa in particular, should be deposited as quickly as possible in an appropriate repository (preferably

a Canadian museum administered by the federal or provincial government or by a university), where they will be assured of long-term curatorial care, and where other scientists will have reasonable access".

6. Since there is in Canada no federal agency concerned with the maintenance of biological research collections generally, this brief recommends that the Canadian Museum of Nature take the initiative in developing a national plan for the support of collections, and that an allocation of funds specified for this purpose be added to the annual budget of the Canadian Museum of Nature.

## **Recommandations**

À la lumière des faits étudiés dans le présent mémoire, la Commission biologique du Canada (Arthropodes terrestres) présente les recommandations suivantes aux organismes publics nationaux et provinciaux, ainsi qu'aux universités, qui disposent de fonds pour le soutien des sciences au pays.

1. Les collections de recherche sur les arthropodes terrestres et les programmes de conservation associés constituent une partie importante des ressources scientifiques et culturelles du Canada à l'échelle nationale et provinciale. Ces collections et programmes sont la contribution canadienne à la documentation des organismes vivants du monde entier, documentation essentielle pour mieux comprendre des écosystèmes naturels. Par conséquent, il est d'une importance cruciale que leur financement soit maintenu, et au besoin accru, car il s'agit là d'un investissement responsable des fonds publics.
2. Les collections documentées d'insectes et d'autres arthropodes terrestres qui ne peuvent plus être conservées par les établissements ou les particuliers qui en ont actuellement la garde devraient être reconnues en tant qu'importantes ressources scientifiques et transférées dans un musée ou un établissement similaire du Canada, ayant pour mandat de conserver des collections de recherche.
3. Les responsables des programmes scientifiques et environnementaux des gouvernements provinciaux du Canada devraient s'assurer que les collections documentées d'insectes et d'autres arthropodes terrestres, recueillies lors de travaux de recherche biologique sur le terrain financés par les fonds publics, soient conservées dans un établissement régional actif. Dans la plupart des cas, cet établissement serait le musée provincial; ce dernier devrait être doté de l'équipement et du financement nécessaires pour assurer la conservation à long terme des collections.
4. Les universités du Canada qui conservent des collections d'arthropodes terrestres à des fins de recherche et didactiques devraient reconnaître que ces collections et



les travaux de conservation associés font partie intégrante de la formation supérieure et méritent d'être financées comme il se doit. L'absence de ces collections entrave sérieusement les études supérieures en systématique des arthropodes terrestres. Une collection joue un peu le rôle d'une bibliothèque ou, plus précisément, d'archives contenant des données scientifiques irremplaçables.

5. L'aide financière demandée au Conseil de recherches en sciences naturelles et en génie du Canada pour l'acquisition et l'entretien de collections d'arthropodes terrestres devrait être accordée en tant que dépenses légitimes pour fins de recherche. Mais, comme condition de l'aide financière aux collections, il faut que les bénéficiaires se conforment aux guide des subventions du CRSNG: "...Ces collections, entre autres, le matériel type de nouveaux taxons, devraient être déposées aussitôt que possible dans un endroit approprié (de préférence un musée ou un herbarium canadien administré par le gouvernement fédéral ou provincial ou par une université), où elles seront traitées avec soin et accessibles à d'autres scientifiques."
6. Comme il n'existe au Canada aucun organisme fédéral s'occupant de l'entretien des collections de recherche biologique en général, le présent mémoire recommande que le Musée canadien de la nature prenne l'initiative d'élaborer un plan national d'aide aux collections, et que des fonds supplémentaires prévus à cette fin soient ajoutés au budget annuel du Musée canadien de la nature.

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