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## PRESIDENTIAL ADDRESS, 1989: WHY CAN'T LEPIDOPTERISTS BE MORE LIKE BOTANISTS?<sup>1</sup>

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When members of The Lepidopterists' Society elected me to be their President in 1988 I was both honored and flattered. And *honor* is the appropriate term: the Society's Secretary, Treasurer, and Editors do most of the work and provide continuity to our ongoing operations, while the President has only three principal functions—all of which occur within a four-day period at the end of a year of doing not much of any significance. One function is to chair a meeting of the Executive Council. That's done. The second is to pass on the symbols of office to the next President. That's coming up. The third function is to present a Presidential Address. That's right now. And it's the toughest part of the job, because the subject of the address should be one of general interest to the members of the Society, rather than my research, curatorial, and public service activities in which I am intimately involved on a daily basis—and about any of which I could speak for hours with few or no notes. The task is made easier, however, by my being able to say what I think without having to prove it, and by not having to subject my thoughts to the peer-review filter.

The importance of habitat preservation, for the sake of our natural environment, and the importance of collecting *now*, for the sake of advancing our knowledge, are two subjects very important to me, but

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<sup>1</sup> Based on a draft composed in the snug comfort of a van camped at 8400 feet in New Mexico's Sacramento Mountains two days prior to the Society's 40th Annual Meeting in Albuquerque, July 1989. A family emergency necessitated the author's premature departure from the meeting, and the address was never delivered. The author suggests that any errors in logic or lucidity be attributed to a temporarily oxygen-starved brain rather than to any permanent organic disorder.

I chose not to address them further since several of my presidential predecessors have already done so quite adequately.

I considered talking about the fact that human overpopulation is the compelling and ultimate environmental issue, from which virtually all others flow—but I realized that I would only be telling you something you already know, particularly since our eminent fellow lepidopterist, Paul Ehrlich, is one of the most outspoken and eloquent proponents of this view.

On my way to this meeting I spent several days exploring the cultural and natural riches of this magnificent state of New Mexico. Besides learning that Deming is the home of “clean water and fast ducks,” in the course of some very fruitful botanizing I realized that the state flower, *Yucca elata*, is clearly one of the most spectacular and striking plants in the American Southwest.

Ever since my college days in Michigan I've been fascinated by plant identification, not only as a direct adjunct to the study of Lepidoptera and the food they eat, but also as a tool for understanding and describing habitat differences and, frankly, just for the fun of learning the name of another organism I've met in my travels. Now, no matter where I go, I am able to recognize a few old friends, while encountering a lot of new plants I've never seen before. I still remember my surprise when I discovered that my midwestern botanizing had left me totally unprepared for a *woody* composite, which I encountered in abundance soon after moving to the Southwest.

My old friends, *Gray's Manual of Botany* and the *Spring Flora of Wisconsin*, were useless in my new environment, as I found myself having to build an entirely new botanical reference library to help me cope with all the surprises that awaited me. And I was not disappointed—plant books by the score abounded: handbooks on trees and shrubs of southern California; trees, shrubs, and wildflowers of the Sierra Nevada; cacti of California; wildflowers of the California desert; keys to the flowers and shrubs of the desert; a manual of southern California plants; a manual of plants for the entire state of California—my shelves groaned, and sagged even further as my travels and botanical interests took me farther afield into adjacent states and Mexico.

But the point is that I have been able to find a book to identify virtually any plant nearly everywhere my travels have taken me—and yet I live in a state with at least 3000 species of moths and nary a list of what those species are, much less where and when they occur within the state and how to identify them.

Had I stumbled upon the Great American Anomaly? Or some Grievous Inequity? I finally had a subject worthy of Presidential exploration.

Was this abundance of plant manuals peculiar to California? A stroll

through the Museum's botany library quickly convinced me that this was indeed not the case. A sample of some North American titles I found: *A Flora of Tropical Florida* (Long & Lahela 1976); *Manual of the Plants of Colorado* (Harrington 1954); *Arizona Flora* (Kearney & Peebles 1951—treating 3370 species!); *Flora of Alaska* (Anderson 1959); *Wild Flowers of the United States* (Rickett, various dates; multi-volume regional work heavily illustrated with color photos); *Illustrated Flora of the Pacific States* (Abrams 1940–1960); *Trees, Shrubs, and Woody Vines of the Southwest* (Small 1972); *Gray's Manual of Botany* (Fernald 1950—treating 5523 species of the northeastern U.S.); *Manual of the Vascular Plants of Texas* (Correll & Johnston 1970—treating nearly 5000 species!); *A Utah Flora* (Welsh et al. 1987—treating 2572 species); *Intermountain Flora* (Cronquist et al., various dates); *Aquatic and Wetland Plants of Southwestern United States* (Correll & Correll 1975); and *Flora of Baja California* (Wiggins 1980—treating 2705 species).

Furthermore, I found numerous more specialized manuals and monographs, including *Moss Flora of North America* (Grout 1972); *Agaves of Continental North America* (Gentry 1982); *Atlas of North American Astragalus* (Barneby 1964), and *Manual of the Grasses of the United States* (Hitchcock 1951). Wow!

How does this abundance of botanical manuals compare with identification tools available for Lepidoptera? Although I shall be concentrating on comparisons within the North American flora and fauna, with which I am most familiar, similar comparisons most likely can be made everywhere else on earth with the possible exception of western Europe.

Butterfly people have it easy. Many state and regional manuals have been published, with many still in print (e.g., New York, Michigan, Missouri, Georgia, Oregon, Indiana, Rocky Mountains), not to mention several readily available continent-wide identification manuals by Scott, Howe, Ehrlich and Ehrlich and, for the skippers, by Evans, Freeman, and Lindsey, Bell, and Williams, *PLUS* a comprehensive bibliography of all state and regional butterfly lists *ever* published for North America (Field et al. 1974). Most regional manuals have been written as a labor of love by non-professionals (that is to say, by people who aren't paid to be lepidopterists).

Identifying a moth in North America is another story altogether, and I think that our scarcity of identification references is the *fundamental* reason we don't have more moth collectors. To test this view I examined the moth handbooks in my office and found deficiencies in virtually all of them. Here are some examples from the North American fauna for continent-wide works:

1. Noctuidae, one of the largest moth families, with at least one widely collected genus (*Catocala*):
  - a. Hampson (1903–1913), *Catalogue of the Lepidoptera Phalaenae in the British Museum*, Vols. 4–13: treated all world species known at the time, including all North American species; now out of date, expensive, and not fully illustrated.
  - b. Seitz (1923), *Macrolepidoptera of the World*, Vol. 7: never completed, expensive, out of date.
  - c. Barnes & McDunnough (1918), *Illustrations of the North American species of the genus Catocala*: out of print, hard to find, expensive, out of date.
  - d. Lafontaine (1987), *Euxoa, Moths of America North of Mexico*, Fascicle 27.2: treats only a single (but large) genus, expensive.
2. Phycitine Pyralidae: Heinrich (1956), *American Moths of the Subfamily Phycitinae*: excellent genitalic figures for virtually all species in the Western Hemisphere, but not a single photograph of an adult moth!
3. *Acrolophus*: monographed by Hasbrouck (1964), male genitalia well figured, but lacks figures of female genitalia and has no photos of adults.
4. Pterophoridae: monographed by Barnes & Lindsey (1921): surprisingly useful but now outdated and hard to find.
5. Olethreutine Tortricidae: monographed by Heinrich (1923, 1926): genitalia well illustrated but not a single figure of wing pattern, now hard to find and somewhat outdated.

Although *The Moths of America North of Mexico* series is slowly filling the void in identification manuals for the North American fauna, and doing it in a superb fashion, it is beset with at least three lingering problems: it is unquestionably slow (begun 18 years ago), it is expensive, and it tends to be biased toward eastern collections.

With very few exceptions, the regional identification manuals for North America are similarly limited:

1. Forbes (1954), *Lepidoptera of New York and Neighboring States*, Part III, is the only comprehensive state faunal identification manual that contains *keys*, but it suffers from a lack of photographs of adult moths.
2. Kimball (1965), *Lepidoptera of Florida*, is an illustrated and annotated checklist, not an identification manual.
3. Covell (1984), *Field Guide to the Moths of Eastern North America*, is the best regional moth manual we have, but it does not cover the entire fauna.

Every single one of the references cited above is diminished by one or more limitations of being out of date, out of print, incomplete, inadequately illustrated, or too expensive.

Before a comprehensive identification manual can be produced, you first need to have a list of species present in the area to be covered. Several such lists have been published, including:

1. Hodges (1983), *Check List of the Lepidoptera of America North of Mexico* [North American faunal list].
2. Moore (1955), *Annotated List of the Moths of Michigan* [excluded the "microlepidoptera"].
3. Kimball (1964), *Lepidoptera of Florida*.
4. Forbes (various years), *Lepidoptera of New York and Neighboring States*: a comprehensive work that embraced all species known to occur in the state, thus serving as a state list.

In addition, there are a number of lists that inventory, in varying detail, a portion of the moth fauna occurring in a given area, such as those by Tietz (1936, *The Noctuidae of Pennsylvania*); Selman and Barton (1971, *The Sphingidae of Northeast Arkansas*); Metzler (1980, *Saturniidae of Ohio*); and Godfrey, Cashatt, and Glenn's fascinating 1987 annotated checklist of the 30,000 "microlepidoptera" that Murray O. Glenn, a farmer, collected as a hobby in a small section of Illinois.

The search through my library did produce, however, a very few works that approach my concept of the ideal identification manual in that they are current, complete, contain keys and/or diagnoses, and are well illustrated. However, they all have one drawback: they are government or organizational publications unobtainable through normal bookselling channels—you have to scrounge the publisher's name and address, and enter into correspondence to ascertain availability and price. Three examples are McGuffin's series, *Guide to the Geometridae of Canada* (Entomological Society of Canada); Pogue and Lavigne's *The Tortricinae of Wyoming* (1981, University of Wyoming Agricultural Experiment Station); and the unquestioned cream of the crop, to the best of my knowledge the best regional moth identification guide *ever* published in North America, William E. Miller's *Guide to the Olethreutine Moths of Midland North America* (1987, U.S.D.A. Forest Service, Agric. Handbook 660). This last publication could easily serve as an idealized model for the scores of similar manuals we need—the use of color photos is the only improvement it could have used.

I am amazed, or perhaps stunned is a more appropriate word, that neither of the two states with biological or insect survey programs, each having published major works on their insect faunas (Illinois Biological Survey and California Insect Survey), has published a single work on its moth fauna, not even at the family level. Texas, with one of the richest Lepidoptera faunas in North America, has not even produced a guide to its butterflies, not to mention its moths!

This appalling disparity—the abundance of plant identification manuals and the paucity of moth identification manuals—led me to investigate the cause of this discrepancy, with the hope of finding some clue that we lepidopterists can use to our advantage.

At first, I thought that the botanists had it easier because they don't have to deal with the overwhelming numbers of species we moth people face. Wrong! Published estimates for the number of known, named species of Lepidoptera in the world range from 113,000 to 150,000 or more (with some estimates for the actual *total* world fauna, both named and unnamed, of ten times or more this number)—for the sake of this discussion I shall use an estimate of 140,000 known species of Lepidoptera in the world. By comparison, there are some 225,000 species

of flowering plants (dicots and monocots) in the world, or 61% more species of plants than there are of Lepidoptera. In North America north of Mexico, there are more than 11,000 named species of Lepidoptera, compared with *twice* that number of species of plants (22,200).

Considering the fact that most Lepidoptera feed, as larvae, on only one species of plant, or on a few closely related species of plant, and further taking into account that most plants probably serve as host to more than one species of lepidopteran, I think it is reasonable to expect that, on average, there is *at least* one species of lepidopteran for every species of flowering plant (disregarding, for the moment, the species whose larvae feed on lower plants, detritus, etc.). This translates to a *potential* North American Lepidoptera fauna of over 22,000, a reasonable figure when one considers the large numbers of new species being discovered in poorly studied families (e.g., Gelechiidae, Scythrididae). Using these same assumptions for the world Lepidoptera fauna, we can reasonably expect the *potential* world fauna to be about a quarter of a million species, or about twice the number of species we have succeeded in describing in the last 200 years!

No, the botanists have not been so successful because their job has been easier. The *real* reason that botanists know their business so well is because of their subject matter: plants are necessary for converting solar energy to a form that can be utilized by animals, and are thus fundamentally essential for human existence and survival. *Homo sapiens* has a vested and direct interest in plants, not just for food, but for fiber, shelter, medicine, ornamentation, etc. Human survival, population expansion, and colonization all depend on our having an intimate knowledge of botany.

So *of course* we're going to know far more about plants than about any other component of our natural environment, including a lot of apparently non-essential incidental botanical knowledge of no immediate practical advantage acquired during the course of applied research.

What, exactly, do I think is so special about botanists? The two qualities of botany and botanists that I admire most, and which I perceive to be deficient or lacking among lepidopterists, are (1) the availability of an identification manual for virtually any group of plants virtually anywhere on earth, and (2) the ability to agree on the importance of floristic studies, and then to cooperate in providing the funds and staff to accomplish the goals.

Why are botanists so much more successful in understanding their discipline than we lepidopterists? And here I am addressing not the practical, applied aspects of botany, but basic knowledge of natural history, taxonomy, and distribution.

First, there are simply more of them than us! The Lepidopterists' Society has just 1500 members in 50 nations, and is the only organization in North America devoted entirely to Lepidoptera. In contrast, just look at some of the botanical organizations in the United States: Botanical Society of America, American Society of Plant Taxonomists, American Fern Society [there are only 345 species of ferns in North America north of Mexico!], Phycological Society of America (algae), Mycological Society of America (fungi, 1600 members), North American Mycological Association, American Orchid Society, the Bromeliad Society, and doubtless others, not to mention native plant societies, garden clubs, and special interest groups devoted to limited subjects such as bonsai, roses, insectivorous plants, etc.

Secondly, they are publishing fools! Every one of the organizations I just listed has its own publication. Furthermore, numerous other publications emanate from free-standing institutions, such as the Missouri Botanical Garden (*Annals*), New York Botanical Garden (a slew of titles, including *Brittonia*, *Botanical Review*, *Economic Botany*, *Memoirs*, *Flora Neotropica*, etc.), Field Museum of Natural History (*Fieldiana*, with ongoing series on *Ferns & Fern Allies of Guatemala*, *Flora of Peru*, *Flora Costaricensis*, etc.), and Rancho Santa Ana Botanical Garden (*Aliso*), to mention just a few.

The study of plants has certain obvious advantages over the study of Lepidoptera, and I think this is another reason why botanists far outnumber us. Specifically, plants are a lot easier to study—although they are often seasonal (as are leps), they stand still for prolonged scrutiny and manipulation, and can be found in exactly the same spot the next day; they are (usually) diurnal, conspicuous, attractive and esthetically pleasing, and easily observable; many wild species can be adapted for domestic cultivation. Although butterflies (and some moths) share some of these characteristics, the fact that they don't allow a close approach and manipulative examination (without stalking and netting them) makes them unworthy of study by the casual naturalist. And moths—well, you can forget about the general public having an intellectual interest in any moth smaller than a bat, and usually not even then. (Interestingly, the sedentary nature of caterpillars, on the other hand, lends them to be observed in a more leisurely, plant-like, fashion.)

The availability of plant identification manuals seems to have a catalytic effect on a person's interest in botany—being able to readily learn the name of one plant leads to a desire to learn the names of additional plants. In fact, the late Harry Clench, co-founder of our Society, observed a similar positive reinforcement phenomenon when he attributed two spurts in the growth of our domestic membership to the "Klots factor" and the "Ehrlich factor," otherwise unexplained surges in mem-



bership a year after the publication of two popular butterfly field guides—collectors had found a way to identify their captures, at the same time discovering the existence of an organization of similarly inclined naturalists.

There thus seems to be a number of fundamental differences between the study of plants and the study of Lepidoptera, so that the two can not be compared fairly. However, I have left until last one final difference that I think we *can* do something about.

✓ After discussing the matter with entomologists and botanists, I have concluded that entomologists in general, and lepidopterists in particular, tend to be aloof, egotistical, self-centered, selfish, secretive, individualistic, and unwilling or unable to agree on a cooperative national/international agenda. The entomological community appears to have a low general regard for faunistic studies and basic taxonomic research, so that grant proposals in these disciplines receive low marks when competing against sexier or more high-tech fields of entomological inquiry. In the United States I am aware of only one major grant-funded moth faunal survey (in Costa Rica, possibly funded because of the superior reputation of the investigator rather than the significance of the survey itself) and not a single similarly funded taxonomic study. (It is encouraging that there are more and more locally funded, locally focused studies, such as inventories of the butterfly fauna of natural areas, but I am concerned here with the negative national attitude toward such studies.)

Botanists, in contrast, seem to have no difficulty agreeing on the importance of floral surveys and taxonomic research both at home and abroad, and in providing the manpower and finances to accomplish the task. Because botanists agree on the necessity of this type of research, this view is reflected in positive anonymous peer reviews of grant proposals, which are then funded.

Botanists can justify their existence because they study this planet's energy source. We entomologists, and particularly lepidopterists, can justify our existence because we study the primary herbivores, those animals at the bottom of the food chain that benefit man and the ecosystem by providing food for birds, fish, herptiles, and even man, and by recycling nutrients and enriching the soil, by pollinating plants, and so forth, in addition to some of them just being lovely to look at; comparatively few species actually compete with man for food or fiber.

The naked truth of the matter is that we are still very ignorant about one of the best known groups of insects! Not only have we named only about half the species in existence, but we don't know what most of them eat, much less their role in the grand scheme of things. Even more frightening is the fact that they are surely becoming extinct as



rapidly as any other group of organisms as their habitats and hostplants are being destroyed.

It is sad and unfortunate that entomologists as a group are perceived by the general public as harmless at best, insane at worst; while butterfly collectors are frivolous airheads and moth collectors have most likely lost all touch with reality. Burdened as we are with these misperceptions of our worth, it is difficult for us or the object of our inquiry to be taken seriously. The fact that we like our work is complicated by the fact that the animals we study are actually beautiful; it is even more complicated if we work on *small* species, because the general public equates size with significance.

I have now completed my examination of "Why can't lepidopterists be more like botanists?" There may still be some hope for us! The *Moths of America North of Mexico* project and the *Atlas of Neotropical Lepidoptera* project are positive steps in the direction I feel we should be following, but both suffer from a shortage of funds and a severe lack of specialists to participate. (The shortage of taxonomists is a general one, not limited to lepidopterists; the ultimate reason is slashed funding for jobs in systematics as a result of a perceived relative lack of significance of this discipline.) Pending legislation for a national biological inventory would be a major step forward *if* it receives adequate funding.

The most important basis for our Society, and the one that makes us so special, is that we are organized to serve as the meeting ground for amateurs and professionals, for the mutual benefit of both and for the advancement of lepidopterological knowledge. The "professionals," unfortunately, are a vanishing race, torn between the conflicting goals of producing the taxonomic and faunistic monographs and manuals we need so badly on the one hand, and providing guidance and assistance to the amateur community on the other hand. We have seen examples of outstanding work by our amateur members, and I know that many more members are capable of similarly fine contributions if only they could receive a little encouragement and help. Without that help they are left to their own devices, leading to results that may be less than satisfactory.

Short of a miraculous but unlikely increase in funding for taxonomic research, if we are to make any significant progress in understanding the taxonomy and distribution of our Lepidoptera fauna it is absolutely essential that we adopt a plan, a National Lepidoptera Agenda, that will make the most efficient possible use of our biggest resource, our members. The formalization of this Agenda will require a lot of thought by all our members and particularly by the Executive Council, our elected representatives. Some suggestions to consider in the implementation of the Agenda include:

identification and techniques workshops at national meetings  
traveling workshops and seminars to regional meetings  
use of the Publication Fund to publish identification and techniques manuals  
a techniques video (an advanced techniques video could be filmed in a lab or at one of the workshops)  
a newsletter of Lepidoptera taxonomy, a periodical directory of who is working on what group, and who has material available for study  
a directory of taxonomic "holes": a guide to taxa in need of specialists and/or more specimens  
a similar directory of regional/habitat "holes": a guide to areas with poorly known faunas  
participate in national discussions on biological surveys and standardization of databases; contract/cooperate with The Nature Conservancy's Natural Diversity Data Base program  
disseminate information to members on curatorial standards and database management systems  
publish bibliographies of taxonomic revisions (perhaps providing copies of original works on microfilm, computer disc, video disc, or xerographic copies)  
establish a "specialist network" to make critical identifications for faunistic publications  
compile a directory of "visiting specialists" willing to provide on-site taxonomic assistance to those paying expenses  
publish a directory of research collections willing to accept and curate voucher specimens from faunal surveys  
publish a leaflet on how to ship specimens safely  
publish a handbook or video on rearing techniques  
promote preservation of larvae and parasitoids by publishing a leaflet on proper techniques  
reinstate/resurrect the larval voucher repository program  
commission/solicit and publish a compendium of hostplant data for North American "microlepidoptera" (to complement data in Tietz); consider funding or seek grant for development of a database for this purpose  
consider establishing a network of semi-autonomous regional branches or affiliates (including existing regional groups), to foster communication, standardization, and unification of purpose

Proposing suggestions is easy; implementing them is the tough part. Although the Society has an abundance of very talented and capable members, fewer than 10 of them—all volunteers—are responsible for our day-to-day operation. With a little leadership and guidance from the Executive Council, let us hope that more of our members will become personally involved in helping to make the National Lepidoptera Agenda become a reality. Perhaps lepidopterists *can* be more like botanists.

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