



# ATBI QUARTERLY

Great Smoky Mountains National Park, Great Smoky Mountains Association, Friends of the Smokies, and Discover Life in America

## Team Odonate is Established

Charles Muise



Charles Muise

Team Odonate at Abrams Creek.

On Wednesday, May 11, 2005 eight people, including Park staff, ATBI volunteers and educators at Great Smoky Mountains Institute at Tremont met to form "Team Odonate." The meeting started with some discussion about how to study odonates (the order comprised of dragonflies and damselflies), locations to survey, when and how to collect specimens, and tips on identification. Not wanting to miss a nice evening, we then traveled to Gourley Pond in Cades Cove to see what was flying.

Prior to the group's founding, some surveys of odonates had occurred, but the data were not stored in a central location, so the Park list was only about 35 species. That changed in August 2004 when Keith Langdon received a list of odonates found at Cades Cove from a group led by David Trently and myself. Some of the species were not on the official Park list, though their presence was not a surprise. Keith forwarded the list to others, who immediately began to send him their own lists, and as a result, the Park's official list nearly doubled. A few treks into the field yielded more information, including a new species to the region.

But before much more could be done, winter set in and the odonates stopped flying. During the cold months, a few nymphs were identified with the help of Park Curator Adriean Mayor. Photographs and scans were collected and distributed, and a real plan began to form for studying these acrobatic predators. Also, we had a goal to bring the Park's official list of odonates up to 90 species.

The following spring, Team Odonate was formed and swung into high gear. Tremont groups, usually led by myself, David, and Gar Secrist, sampled Cades Cove and the Tremont area repeatedly, sometimes finding up to 17 species in a day. Keith and Rebecca Shiflett monitored Foothills Parkway-west in Walland where they added 2 more Park records in mid-July. Keith and I led a trip to low elevation areas in North Carolina where we found an amazing number of odonates near Smokemont, particularly citrine forktails and fragile forktails. Everyone began to pay more attention to "odes" while in the field for other reasons. Some areas were checked at least monthly April through September of this year, while others were surveyed just once and deserve more effort.

Finding new records is not the only focus of the team. We also are working to determine the range within the Park for each species. Also of interest are records of breeding behavior, such as pairs flying in tandem. In late August, 2005, our goal of reaching 90 species on the Park list was met, and by the end of September it stood at 92. This winter we will consolidate specimens, enter data into the ATBI database, and plan 2006 field activities, including amphibious sampling on Fontana Reservoir. Contact us if you would like to be involved.

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Charles Muise

Clamp-tipped emerald dragonfly (*Somatochlora tenebrosa*).



Charles Muise

Ruby spot damselfly (*Hetaerina americana*).

# Chairman's Corner

Peter S. White

The All Taxa Biodiversity Inventory in Great Smoky Mountains National Park is the largest biological inventory in the country and must surely compete for one of the largest of its kind in the world. Of course, you all know that the ATBI is about diversity, but why is diversity important? Why do I like diversity? But “like” is not the right word, so let me rephrase - why am I THRILLED by diversity? We scientists always feel the need to apologize for a personal answer—but here I write decidedly personal thoughts.

Dr. E. O. Wilson argues that humans evolved in a diverse biological world and that our complex brains are complex in part because of the diversity around us, a match between an inner and outer complexity. He goes on to argue that we are wired to derive pleasure and satisfaction from living, knowing, and exploring biological complexity. He calls it “biophilia”, the love of a biologically rich world. We are not the first human beings in the Smokies landscape to love the fact that every cove, every slope, is teeming with life. The Cherokee had knowledge of and uses for over 800 plants, a high percentage of the Park’s native flora. That required observation, recognition, conceptualizing, and naming.

Personally, I have to agree with Wilson. I am thrilled by the new-things-found-under-rocks that you read about in these pages. I am thrilled by the sense of being on the edge of the unknown and applying our interest, skills, knowledge, and what dollars we can find towards pushing back that edge, increasing the known at the expense of the unknown. Maybe there also is a thrill to putting a “moon rover” on Mars - but I just have to say how astounding our own world is. Whether or not a few remnants of living things are found on Mars, from some earlier wetter and warmer period on that planet, evolution has created a vast symphony, a master work, of life forms here.

I could go on, of course, to say why it is important that we know about diversity: the species that will provide future medicines, the species that make ecosystems work, the species that are warning signs of air pollution, the species that are like the nail in the horseshoe that lost the horse that lost the battle that lost the kingdom. But I am reminded of a Robert Frost poem, *The Tuft of Flowers*, about a milkweed and a butterfly, that gives us the idea of simply loving diversity. In the poem, Frost comes unexpectedly upon a “leaping tongue of bloom the scythe had spared, beside a reedy brook the scythe had bared” and writes “the mower in the dew had loved them thus, in leaving them to flourish, not for us, nor yet to draw one thought of ours to him, but from sheer morning gladness at the brim.” Biophilia!

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## Science Advisory Panel

Dr. Dan Janzen, University of Pennsylvania  
Dr. Tom Lovejoy, The Heinz Center  
Dr. Ron Pulliam, University of Georgia  
Dr. Peter Raven, Missouri Botanical Garden  
Dr. Edward O. Wilson, Harvard University

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## Science Center Contract Awarded

The contract for construction of the Science Center at Twin Creeks has been awarded! With some last minute negotiations, an agreement was reached before the end of the fiscal year (September 30). The contract was signed with Hedges Construction of Fairburn, GA to build the almost \$4.5 million center. Ground breaking will take place this winter. This 14,600 square foot building will include a curation room for the Park's natural history collection, a large work area for DLIA scientists, a wet lab, a rearing room for invertebrates, an education room, and offices for the Inventory and Monitoring staff, other Park researchers, some Resource Education staff, and DLIA staff and volunteers. Many thanks to all of those involved with making this happen after so many years!

# ATBI Taxa Table Update

TAXON	New to Science	New to Park
<b>Microbes</b>		
Archaea	6	1
Bacteria	92	59
Microsporidia	1	4
Protozoa	2	14
<b>Slime molds</b>		
Dictyostelids	10	8
Protostelids	8	12
Myxomycetes	2	130
<b>Algae</b>	67	163
<b>Plants</b>		
vascular	0	47
non-vascular	0	9
<b>Fungi</b>	8	129
<b>Lichens</b>	10	83
<b>Nematomorpha</b> (horsehair worms)	0	5
<b>Mollusks</b> (snails, mussels, etc.)	6	111
<b>Annelids</b>		
aquatic oligochaetes	0	16
earthworms	4	2
leeches	0	8
<b>Nematodes</b> (roundworms)	1	2
<b>Tardigrades</b> (waterbears)	13	58
<b>Arachnids</b>		
spiders	20	243
mites	6	20
ticks	0	5
<b>Crustaceans</b> (crayfish, copepods, etc.)	29	56
<b>Diplopoda</b> (millipedes)	1	2
<b>Pauropoda</b> (pauropods)	20	27
<b>Symphyla</b> (symphylans)	5	1
<b>Protura</b> (proturans)	10	5
<b>Collembola</b> (springtails)	46	104

TAXON	New to Science	New to Park
<b>Diplura</b> (diplurans)	3	2
<b>Microcoryphia</b> (jumping bristletails)	1	2
<b>Ephemeroptera</b> (mayflies)	4	4
<b>Odonata</b> (dragonflies, damselflies)	0	29
<b>Orthoptera</b> (grasshoppers, crickets, etc.)	0	10
<b>Blattaria</b> (cockroaches)	0	1
<b>Plecoptera</b> (stoneflies)	3	4
<b>Psocoptera</b> (barklice)	0	24
<b>Pthiraptera</b> (lice)	0	13
<b>Hemiptera</b> (true bugs, hoppers)	4	148
<b>Neuroptera</b> (lacewings, antlions, etc.)	0	23
<b>Megaloptera</b> (dobsonflies, alderflies, etc.)	0	1
<b>Coleoptera</b> (beetles)	28	986
<b>Mecoptera</b> (scorpionflies)	1	10
<b>Siphonaptera</b> (fleas)	1	7
<b>Diptera</b> (flies)	50	158
<b>Trichoptera</b> (caddisflies)	4	72
<b>Lepidoptera</b> (butterflies, moths, skippers)	72	688
<b>Hymenoptera</b> (bees, ants, etc.)	27	60
<b>Vertebrates</b>		
amphibians	0	2
reptiles	0	2
mammals	0	1
birds	0	1
<b>TOTAL:</b>	<b>565</b>	<b>3,572</b>

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# Aphids: Diverse and Distinctive

Colin Favret

Aphids are small sap-sucking insects and are one of the few insect groups with more species in temperate regions than in the tropics. The biology of aphids is very diverse - some aphid species exhibit the same level of sociality as bees, ants, and termites, some form galls, some are tended by ants, and some are important vectors of plant viruses. Aphids are largely asexual, with females giving birth to female offspring (parthenogenetic reproduction) for most of the year, with mating occurring only in the fall when it comes time to lay eggs. Because immature aphids are born live and already pregnant, this form of asexual reproduction allows them to be extremely prolific. Some aphid species go through host alternation, where they feed on a woody host in the spring, migrate to an herbaceous host in the summer, and then return to the primary host in the fall to lay eggs that hatch the next spring. By certain measures, aphids are the most economically damaging group of crop pests.

Perhaps the most interesting aspect of aphid biology is the number of different forms, or morphs, each species has. The typical aphid species produces the following morphs: a colony foundress that hatches from the egg, winged and wingless live-bearing females, males, and sexual females that mate and lay eggs. All five of these morphs are more or less distinct, and occasionally scientists have accidentally



Colin Favret

A conifer aphid, *Cinara atlantica*, feeding on the growing tip of pitch pine, *Pinus rigida*, and tended by the odorous house ant, *Tapinoma sessile*.

described different morphs as different species. If the species alternates hosts, several of these morphs may have differing counterparts on the secondary host for a total of eight or more different forms of the same aphid species.

Aphids are distinct as a group, with almost all species having variously shaped tail pipes, or cornicles (structures used to release defensive chemicals), attached to their abdomen. However, many species are very hard or impossible to distinguish by body characteristics, and knowledge of the host plant is often crucial to being able to identify an individual. Collecting aphids in the field often means collecting a cutting of the host plant for identification as well.

This is the third season of targeted aphid collecting in Great Smoky Mountains National Park. Thus far, 97 named species have been collected, with some additional undetermined specimens and even species new to science. In all, 105 different host associations also have been documented. Although aphids are generally specific to certain hosts, the most commonly encountered aphid in the Park, the foxglove aphid, was collected on 33 different host species, including squawroot - the first record of an aphid feeding on a parasitic plant.

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Colin Favret

A common aphid of the Smokies, *Uroleucon eupatoricolens*, comes in green and red forms, and feeds on various species of *Eupatorium*. Note the droplet of alarm pheromone being released from one of the cornicles.

# Survey of Water Mite Diversity Begins

Ian M. Smith and Andrea J. Radwell

Water mites are a monophyletic (developing from a single ancestral form) freshwater group of the Acari (mites and ticks) which is the largest subclass of arachnids and rivals the insects in taxonomic and ecological diversity in most habitats. Larval water mites typically are parasitic on aquatic insect hosts and exhibit strong host specificity. Post-larval stages are predacious, mainly on the eggs and larvae of insects and other small invertebrates. Parasitism and predation by water mites have been shown to have a significant impact on the structure and dynamics of aquatic insect populations. Thankfully, water mites are only distantly related to the chiggers we find so annoying, making us unsuitable hosts – although larvae of at least one species of the water mite genus *Thermacarus* have been known to sample bathers in hot springs.

Water mites are well represented in virtually every freshwater habitat and are among the most abundant and taxonomically diverse groups. Water mite assemblages in many healthy freshwater habitats comprise 50 or more species in more than 20 genera, and they often reach population densities of several thousand individuals per square meter of substrate. Although tiny, usually ranging from 1 to 5 millimeters in size, water mites exhibit a remarkably wide range of morphological and behavioral adaptations for moving about, hunting, and mating in their particular aquatic microhabitat. Species living in flowing water typically have slender or flat bodies that allow them to walk and crawl through small spaces in stony or gravelly substrates protected from strong currents. In standing water, most water mite species are strong swimmers and move actively through the water column in search of prey.

During September, 2005, the nearly perfect weather allowed us to initiate our survey of water mite diversity in the Smokies, which involved collecting several thousand specimens from over 50 habitats representing rivers, streams, waterfalls and spring runs in several watersheds. We expect to identify well over 100 species from our collections, all of which will be new records for the Park. Many of these also will be undescribed species. Our work in the Smokies will contribute substantially to knowledge of the taxonomic diversity of water mites in the southeastern United States. It also will improve our understanding of the historical and ecological factors that have interacted to determine species distributions in the southern Appalachians. We will then have the information needed to develop keys, diagnostic tools, and distribution maps so that water mites can be included in studies of the structure and function of freshwater communities in the Park. Expect to hear more about water mite species as we work through our collections.

Over 6,000 species of water mites have been described worldwide, but the fauna of many regions including North



Jeanie Hiten

Ian Smith and Andrea Radwell sampling water mites in a riffle Abrams Creek in Cades Cove.



*Torrenticola* sp, a representative water mite from one of the 136 genera known from North America.

America remains incompletely known. More than 1,500 species are known to occur in the United States and Canada, although many of them are undescribed and unnamed and consequently unreported in the literature. We can expect additional new taxa to be discovered in North America and throughout the world for many years to come. The ATBI in Great Smoky Mountains National Park is a particularly fortuitous opportunity for us because the southeastern United States is one of the least explored areas of the continent for water mites. We anticipate some exciting discoveries including endemic species whose closest relatives live in other unglaciated areas of the Holarctic Region. We are already looking forward to next spring when we hope to visit areas of the Park not yet surveyed, including the potentially rich watersheds on the North Carolina side.

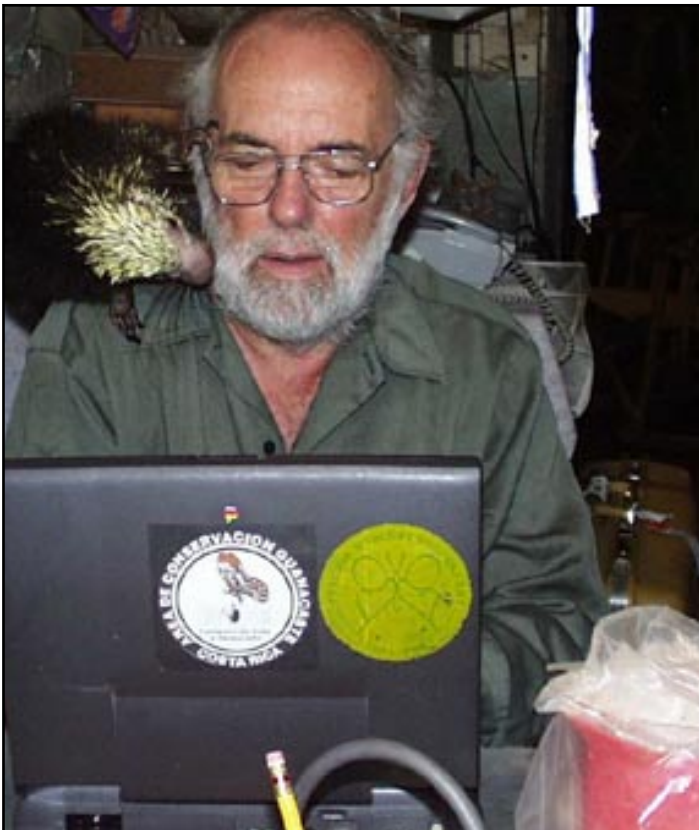
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## Dr. Daniel Janzen is Keynote Speaker at DLIA/ATBI Annual Conference

Jeanie Hilten



Espinita, a prehensile-tailed porcupine, observes Dr. Janzen at work in Costa Rica.

Since the first glimmerings of biodiversity research in Great Smoky Mountains National Park, tropical ecologist and entomologist Dr. Daniel Janzen has played a key role in motivating our efforts. He uttered to Keith Langdon the now famous words, “What you need is an ATBI!” From those conversations, our founding fathers and mothers organized the December 1997 conference and the beginning of this remarkable project. Dr. Janzen will present his keynote address at Sugarlands Visitor Center on Wednesday, December 7 at 6:00 pm, and afterwards there will be a reception buffet for him and his wife/co-researcher, Winnie Hallwachs. Dan will discuss their efforts to inventory the entire butterfly and moth fauna, via caterpillars, of the Area de Conservación Guanacaste in northwestern Costa Rica, and the positive impacts of the new method of DNA barcoding on inventories - all relevant to what we are doing in the Great Smokies.

Born in 1939 in Milwaukee, Wisconsin, Dan Janzen is the DiMaura Professor of Conservation Biology at the University of Pennsylvania. While initially focused on tropical animal-plant relationships, Dr. Janzen is currently focused on biodiversity and inventories of tropical caterpillars,

their parasites, and their microbial diversity, and on the conservation of tropical biodiversity through non-damaging development (see <http://janzen.sas.upenn.edu>). His 417 publications encapsulate much of this information and its associated relevance for tropical science administration and conservation biology. He and Winnie are among the primary architects of the Area de Conservación Guanacaste (ACG; <http://www.acguanacaste.ac.cr>), which was decreed a UNESCO World Heritage Site in 1999.

Dan’s 50 years as a tropical ecologist have placed emphasis on:

- Costa Rican dry forests and the interactions between animals and plants therein,
- biodiversity inventories in complex tropical habitats,
- administration and management of biodiversity in large complex tropical conserved wildlands,
- development of government and non-government biodiversity institutions, and
- non-damaging use of biodiversity (biodiversity development).

Dr. Janzen’s keynote and the reception are included in the conference general registration or with the \$25 one-day registration. The rest of the conference, from December 6-9, will be at the Holiday Inn Sunspree this year and will include an “ATBI Alliance” meeting and a “Databasing and Data Quality” workshop on Tuesday, December 6. The general sessions are from Wednesday, December 7—Friday, December 9, with the “Bids for Biodiversity” silent auction Thursday evening, and a science education emphasis on Thursday, December 8.

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**Be sure to visit the DLIA website, [www.dlia.org](http://www.dlia.org) or call the Discover Life in America office at 865-430-4752 for more details about this year’s gathering and registration information.**

# Down in the Dirt

Tommy Allen

The soil fauna is a ubiquitous nether world, mostly taken for granted and seldom studied in detail. The general public and even many biologists do not realize that the fauna in the leaf litter and uppermost soil layers (18 inches) is as diverse taxonomically and as complex ecologically as the above-ground fauna. The soil is not a realm of glamorous creatures. I doubt there are any "Save the Apterygotes!" bumper stickers. Yet soil ecosystems are immensely important, a foundation to all other ecosystems on the planet. Fortunately, the ATBI program in Great Smoky Mountains National Park (GSNMP) has included a number of biologists working with soil organisms, notably Fred Coyle on spiders and Ulf Scheller on pauropods, through its grants program. This past summer I was honored to receive a grant to work mainly on two groups of soil organisms, the Diplura and the Protura.

My wife, Sue, accompanied me on this research trip, and the experience we had during June and July of 2005 certainly demonstrated to us what can be accomplished, and what is left to be accomplished in soil research in GSMNP. Sue and I began work in early June in the Cades Cove area. Throughout the summer we systematically worked our way around and through as much of the Park as we could. Our typical day included hand collecting Diplura under stones, in rotting logs and tree stumps and in the first 3-6 inches of soil. We also collected litter samples at many of the sites for processing later. In the late afternoon we took our litter booty to the "Apple Shed" at the Twin Creeks Natural Resources Center where we had set up 16 extraction funnels. The funnels ran almost continuously during our two-month stay in the Park.

Diplura and Protura have the disadvantage of needing to be mounted on microscope slides for identification. The procedure takes about a week from the time the animals are collected until



Tommy and Sue Allen at the University of Tennessee's field lab.

Jeanie Hilten

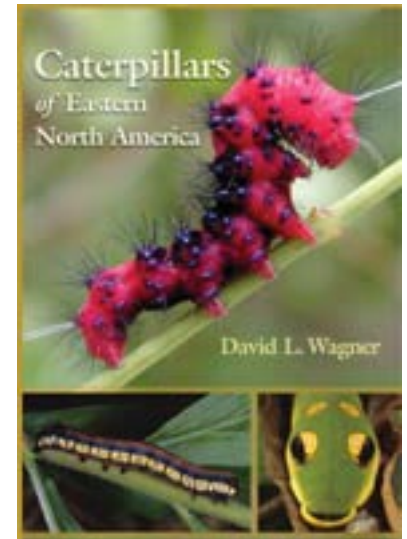
the slides are dried and they can be viewed. We brought with us from the Academy of Natural Sciences, Philadelphia, most of the equipment and supplies we needed. Dr. Charles Parker also loaned us the use of his phase contrast microscope to assist with the preliminary identifications to the family level and even genus and species in some instances. As a result, we were able to spend our late afternoons and evenings mounting, identifying, and logging data for the specimens as we collected them.

In early July we collected five Diplura specimens near Newfound Gap belonging to the genus *Litocampa*. Two previously described species, *Litocampa condei* Ferguson and *L. appalachiensis* Allen (collected 2003), were known from the Newfound Gap/Clingman's Dome area. But the new specimens appeared to be different and undescribed. We returned to the Newfound Gap site and were able to collect an additional 15 specimens. Further study has indeed confirmed that these specimens belong to a new species. It will be named *Litocampa jeaniewae* in recognition of the outstanding contributions Jeanie Hilten has contributed to the success of the ATBI.

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## Discover Life in America Figures Prominently in New Field Guide

Dave Wagner's book ***A Field Guide to Caterpillars of Eastern North America*** (Princeton University Press) acknowledges DLIA on its title page. The full-



color identification guide treats nearly 700 species of common, economically significant, beautiful, or otherwise apt-to-be-asked-about caterpillars. The work has found a broad audience among curators, forest managers, nature centers, photographers, and educators—the first printing was exhausted by mid-September.

Many of the images in the book are derived from Wagner's visits to the Park, and in particular, the four Lepidoptera bio-blitzes organized by Dave and Brian Scholtens. Perhaps as many as 10% of the species in the book were reared from collections made by Dave at and around the ATBI Cosby House and Foothills Parkway-east.

Many images from the new guide will be featured in Wagner's talk "The Myriad Defenses of Caterpillars" on Thursday afternoon December 8th at this year's Annual Conference. The wide-ranging, image-rich talk will review the wonderfully deceitful ploys that caterpillars employ to dupe birds and other would-be predators. Along the way, he will touch on silk, spices, and other stuff you'd never associate with a bunch of bugs. Dave will be available afterwards for a book signing.



**DLIA - ATBI Annual Conference  
December 6 - 9  
Registration Form**

Name: \_\_\_\_\_

Affiliation: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip \_\_\_\_\_

Phone: \_\_\_\_\_ E-mail \_\_\_\_\_

Registration Fee (\$60.00 general or \$40.00 student)  
before - November 15. \$\_\_\_\_ enclosed

Late Registration Fee (\$80 general and \$40 student) after  
November 15. \$\_\_\_\_ enclosed

Registration "Alliance of ATBIs" Meeting  
\_\_\_\_ Yes (free of charge)

Registration "Databasing and Data Quality" Workshop  
\_\_\_\_ Yes (free of charge)

Please write your check and mail this form to:  
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Gatlinburg, TN 37738

Yes! I'd like to donate an item for the "Bids for Biodiversity"  
Silent Auction!

Item and description: \_\_\_\_\_

For more details about the Auction, contact Melinda Wilson,  
865-430-4756 or Melinda@dlia.org



**DLIA Education Committee to Award  
"Outstanding Biodiversity Educator of  
the Year" and "Outstanding Scientist of  
the Year for Biodiversity Education"**

Nominate Now!

For the 2nd consecutive year, the Discover Life in America Education Committee will recognize outstanding educators and scientists for their contributions to the All Taxa Biodiversity Inventory.

So many individuals go above and beyond in their efforts to promote science and education, and such dedication and service will be applauded.

If you know of an individual who deserves recognition, please contact Jennifer Pierce, Jennifer\_Pierce@nps.gov or at 865-436-1713. All nominations must be received by November 11th, 2005. Selected Nominees will be announced during the 2005 DLIA conference in Gatlinburg, TN.

[www.dlia.org](http://www.dlia.org)



**Jeanie Hiltens Photographs of DLIA Summer Activities**