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BAT CONSERVATION INTERNATIONAL



MIGRATING
BATS:
INTO THE WIND

BATS

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COVER PHOTO: Migrating hoary bats (*Lasiurus cinereus*) are among the bat species most frequently killed by wind-energy turbines in North America. (See Page 1) The first known photograph of mating hoary bats was taken in Colorado. (See Page 15)

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PRAIRIE WINDS

MIGRATING BATS & WIND ENERGY IN CANADA

by *Erin Baerwald*

Migratory tree bats – hoary, silver-haired and eastern red bats – are among the most spectacular and widespread bats in North America, yet we know very little about them and almost nothing of their migratory behavior. Studying these bats (and their encounters with wind-energy turbines) on the Canadian prairies might seem a little crazy. The featureless landscape with few trees and scarce water is hardly prime bat habitat. The winds that blow strongly and incessantly make catching bats almost impossible. And when I began my research two years ago, high bat kills at wind turbines seemed mostly limited to facilities built on forested ridgetops in eastern North America.

COURTESY OF ROBERT M.F. BARCLAY

The Summerview Wind Farm in Alberta, Canada



Erin Baerwald (*right*) and Brandon Klug record data describing a bat carcass found at the Summerview Wind Farm.

Nonetheless, the southwestern Alberta prairie is where I chose to study migratory bats and wind energy. Little did I suspect that meant I would become a diurnal bat biologist, slogging through waist-high wheat in 104-degree F (40-degree C) heat or hailstorms or snow. Knowing that we were adding to our understanding of the basic biology of migratory tree bats while perhaps also helping to reduce the wind-energy

risks to bats kept me and my team going through the unpredictable conditions of the bat-migration season on the prairie.

I began my research at the Summerview Wind Farm in fall 2005, shortly after environmental consultants for the owner, Transalta Wind, began reporting large numbers of bat fatalities at the new facility. They found 532 hoary and silver-haired bats under Summerview's 39 turbines in 2005. That fatality rate of 14 bats per turbine per year was unprecedented in Alberta – other wind-energy installations in the region had fatality rates of less than one bat per turbine-year. [These rates are not corrected for searcher efficiency and carcass removal by predators, which would significantly increase the totals.]

It also came as a huge surprise to bat biologists and the wind-energy industry. High bat-fatality rates had been recorded at the Mountaineer Wind Energy Center in West Virginia, and reports were beginning to trickle in from other wind-energy installations (*see* BATS, *Fall 2005 & Fall 2006*). But the flatland prairie at Summerview had little in common with the eastern ridgetops on the other side of the continent. These bat fatalities in Canada suggested the issue was much broader than anticipated.

Some patterns were emerging, however. At North American locations studied thus far, most bat fatalities at wind-energy facilities have occurred in late summer and early



Erin Baerwald of the University of Calgary examines the body of a bat killed by a wind turbine at an energy facility on the Canadian prairie.

fall and mostly involve three migratory species: hoary bats (*Lasiurus cinereus*), eastern red bats (*Lasiurus borealis*), and silver-haired bats (*Lasionycteris noctivagans*). This pattern appeared to hold true at Summerview, where more than 90 percent of fatalities occurred between July and September and involved hoary and silver-haired bats.

I had already been in consultation with Transalta, and we took the opportunity to collaborate with other industry partners (Suncor Energy Inc., Alberta Wind Energy Corporation and ENMAX Corporation) to investigate the causes of bat fatalities and learn more about the basic biology of migratory bats in Alberta. My work this year is supported in part by a BCI Student Research Scholarship.

Among research goals, I am determining how weather and time of night might influence migrations and fatalities; how migratory activity varies across the landscape; and the effectiveness of acoustic monitoring in predicting the risk to bats at proposed wind-energy sites. Field research and data analysis continue, but my initial results include hints that might help reduce bat kills at some wind farms.

In my first field season in 2006, I spent May through September at three existing wind farms and three other sites where wind facilities are proposed in southern Alberta. Summerview was my primary study site. From mid-July to the



COURTESY OF BRANDON KLUG

Bat detectors were tested to monitor bat activity and examine echolocation behavior near the turbines. Detectors, such as this one, mounted at the bases of wind turbines proved ineffective at monitoring migratory bats. Those placed high on the towers were much more useful.

end of September, my field assistants and I conducted daily searches around 10 of Summerview's 39 turbines, carefully looking for dead or injured bats. We searched the other 29 turbines once a week. We also used Anabat detectors to estimate the activity of different bat species as they passed through the wind-energy installations each night.

We counted 619 dead bats around the turbines in 2006. Most (62 percent) were hoary bats, and 34 percent were silver-haired bats. The eastern red bat, frequently killed at wind farms in eastern North America, is considered rare in Alberta. Yet we found the carcasses of five of them under the turbines.

Previous studies had suggested that only female hoary bats migrate into northwestern Canada. We, however, found more male hoary bats than females. We also documented that both males and females, and juveniles as well adults, are vulnerable to being hit by turbine blades.

A curious feature of bat fatalities at wind-energy sites studied across North America is that they occur mainly in the fall, as bats migrate south for the winter, but rarely in the spring. Somehow, the bats avoid wind turbines on their northward migration. That clearly is the case in Alberta: Fatalities begin in mid to late July, peak in August and taper off by the end of September.

We also found that different species and sexes migrated at different times. In July, we found mainly male hoary bats. Then came the females and their young. Mixed age and gender groups of silver-haired bats accounted for most of the fatalities in September.



The migratory eastern red bat is one of the most common victims of wind-turbine blades in eastern North America.

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It seems puzzling that bats are struck by structures as large as turbine blades, yet they can use their echolocation system to detect a fruit fly. Some biologists have suggested that bats may simply turn echolocation off during migration. My results suggest this is not the case.

With the help of Transalta personnel who climbed up inside the 213-foot-high (65-meter) turbine towers, I mounted bat detectors on the hubs of several wind turbines and on weather-monitoring towers. Echolocation calls of migratory hoary, silver-haired and red bats were detected.

Detectors on the ground, however, mostly recorded the echolocation calls of the area's (non-migratory) resident bats, such as little brown myotis (*Myotis lucifugus*) and big brown bats (*Eptesicus fuscus*), that feed relatively close to the ground and away from the spinning turbine blades. Up high, I recorded few bats of these species, but many more migratory bats. This suggests that ground-level bat detectors may not accurately assess potential risks to migratory bats at proposed wind-energy sites. Monitoring at blade level, which is far more difficult, may be required.

My data from across southern Alberta also suggest that the number of migrating bats varies significantly from site to site. This may help explain why some wind farms have higher bat-

fatality rates than others. If there are strong correlations between migration activity levels and fatality rates, this could help in future site selection.

My initial results are less clear about factors that might influence the timing of bat migrations, a little-understood subject. Particularly high activity was recorded on some nights at some locations, but I found no clear pattern of weather variables associated with these migratory "events." Perhaps the data we are collecting this year will help us tease apart some relevant factors.

Wind energy and other alternative sources of renewable energy are important components of the energy mix and of efforts to reduce global climate change. We must remember, however, that almost everything we do – including renewable energy – has an impact. But with the collaboration of the Canadian wind-energy industry, we are learning about wind energy's impact on bats so that we can minimize those risks. Given the rate of new construction all across North America, studies such as this are urgently needed.

ERIN BAERWALD is a graduate student at the University of Calgary. This research is part of her work toward a Master of Science in Biology.

Threatened in Texas

This opinion column was submitted to newspapers in Central Texas:

The Texas Hill Country, home to the world's largest remaining bat colonies, has recently been the focus of proposals for wind-energy projects. We are deeply concerned about the potentially serious consequences to our Hill Country wildlife – ironically, from an energy source commonly promoted as being "green."

Several of America's leading wind-energy producers – Florida Power and Light, PPM Energy and AES SeaWest – have already investigated the feasibility of large-scale wind-energy facilities in the Hill Country, and we applaud them for their decision to avoid that area due to exceptionally high risks to wildlife.

At least a dozen caves and several bridges and tunnels harbor huge maternity colonies of Mexican free-tailed bats, with a total combined population estimated at close to 100 million. These bats consume approximately 1,000 tons of insects nightly, feeding on Texas' most costly crop pests, including corn earworm, armyworm and tobacco budworm moths. By consuming literally billions of these pests before they can descend on crops, Mexican free-tailed bats in the Hill Country perform vital ecosystem services that if lost could be extremely costly.

Clearly, these bats are invaluable to Texas agriculture, not to mention tourism. Austin's Congress Avenue Bridge

colony alone generates approximately \$10 million in tourism annually. Unfortunately, recent reports from Oklahoma suggest that Mexican free-tailed bats, especially pregnant and nursing mothers, are among America's most vulnerable species when it comes to being killed by wind turbines.

Other sensitive areas within the Texas Gulf Coast are also of deep concern. The Gulf Coast is an area of primary importance for migrating wildlife. The area is geographically situated to serve as a continental funnel for the most populous and diverse array of migrating songbirds, shorebirds, raptors and others, including virtually the entire populations of many species. Most of the birds that breed east of the Rocky Mountains and in the Canadian Arctic pass through this area. Its remaining diverse and intact native habitats make the Gulf Coast the most ecologically diverse region north of the tropics. The coastal prairies, marshes and tidal flats provide a critical wintering area for a range of highly imperiled grassland species and shorebirds, and the Laguna Madre alone supports approximately 80 percent of the global population of wintering redhead ducks.

Although Texas leads the nation in installed wind power producing capacity, including some 1,400 turbines, to our knowledge no peer-reviewed monitoring studies of wildlife impacts have been mandated by the state or conducted at existing facilities. External scientific studies on impacts of wind-energy development in Texas are desperately needed. Those from other states suggest problems for bats that, if not



The research team nursed this injured hoary bat, shown here eating a grasshopper, until it was strong enough for release. The bat survived a collision with a wind turbine.

COURTESY OF MONTY NICOL

soon remedied, could threaten entire species through cumulative impacts. Habitat-related impacts from wind-energy development are largely unknown at this time, but also could prove to be serious if facilities are sited inappropriately.

While we feel it is an individual private landowner's decision whether to participate in wind-energy development, overarching concerns for wildlife impacts create a need for caution. We believe that development of wind energy in areas of especially high wildlife usage, such as certain areas within the Texas Hill Country and Gulf Coast, should be avoided until credible scientific documentation of threat levels and solutions has been gathered.

We applaud AES SeaWest's recent conclusion (in a letter to Gillespie County community leaders dated August 8, 2007):

"We have learned that there are several sensitive species and their habitats that are known to occur in the area, and that these sensitive species and bat colonies could be incompatible with large-scale wind energy. As a company that places an emphasis on environmental stewardship and preservation of wildlife, we are concerned that the site may not be suitable from a wildlife standpoint, and is therefore not a good use of our development resources."

The environmental consciousness demonstrated by AES SeaWest in the Texas Hill Country must be emulated throughout the wind-energy industry. Companies that put wildlife at risk cannot claim to produce "green energy."

Merlin D. Tuttle, Ph.D.

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Professor and Director, Center for Ecology and Conservation Biology, Boston University

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Executive Director, Audubon Texas and Vice President, National Audubon Society

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Gina Donovan

Executive Director, Houston Audubon Society

Carter Smith

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BUSINESSES FOR BATS

Corporate sponsors make conservation work in the Cayman Islands

Pallas's mastiff bats, insect-eaters that are active year-round in the Cayman Islands, are the primary tenants of Lois Blumenthal's bat houses on Grand Cayman.

Bat Conservation International has worked, since its founding 25 years ago, to build alliances rather than enmity with industry whenever possible. We have repeatedly demonstrated the value of this "win-win" philosophy through our many corporate partners who have donated money, time, materials, equipment, expertise and much more toward bat-conservation projects around the world. In the Cayman Islands of the Caribbean, longtime BCI Member Lois Blumenthal proves once again how much can be accomplished by combining enthusiastic volunteers with the support of business.

by Lois Blumenthal

Attitudes about bats in the Cayman Islands have changed dramatically since I began the National Trust Bat Conservation Program in 1994. Back then, they were called "rat-bats" and routinely exterminated. Today, pest-control companies exclude bats humanely from homes and buildings, and most residents of the three Cayman Islands have learned to appreciate the ecological and economic values of our nine species of bats – the islands' only native mammals.

This remarkable transformation would not have been possible without the steadfast support of dedicated corporate partners. With their help, the Cayman Islands' bat conservation program is the largest and most successful in the Caribbean. Partners include Caribbean Utilities Co. Ltd. (CUC), the Marriott Grand Cayman Beach Resort, Cayman Airways, the Ritz-Carlton Grand Cayman, and Truly Nolan (Reliable Industries, Grand Cayman).



PHOTOS COURTESY OF MARY WEINER

The Marriott Grand Cayman Beach Resort, a bat-conservation partner on the islands, installed this bat house on its property. The round hole allows parrots to roost in between the bat chambers.

We believe our cooperative success offers a model that can be reproduced throughout much of the Caribbean and beyond. We don't simply ask for funds, but urge businesses to share both the projects and the credit.

Bat houses are the core of our conservation work. They offer a positive solution to which people respond well. We now have more than 50 customized pairs of nursery houses (each capable of holding more than 300 bats) at strategic locations around the 75 square miles (196 square kilometers) of Grand Cayman.

CUC is the cornerstone of the project. Utility poles are ideal for mounting bat houses, and CUC donates the poles and installs them. This has been crucial to our success. When Hurricane Ivan, one of the worst storms ever to sweep the Caribbean, battered the Cayman Islands with 155 mile-per-hour (260 kilometer-per-hour) winds for two days in September 2004, all 43 existing bat houses mounted on CUC utility poles survived – with the bats safely inside.

A utility company, which already has the poles, equipment and manpower, is a perfect fit for this kind of project, and the conservation value of the donation far exceeds the cost to the company. “We are pleased to contribute to the efforts of the National Trust in providing alternative habitat for our only native mammal,” said Caren Thompson of CUC.

Pallas's mastiff bats (*Molossus molossus*) living in roof spaces were once a major concern for residents of the Cayman Islands. Tropical bats are active year-round and Caribbean roof spaces are usually small and inaccessible. This, combined with high humidity, can create a significant odor problem when large colonies inhabit a building.

Previously, the typical reaction to roof colonies was to try to kill the bats. Now most people turn to the effective, humane and environmentally sound exclusion devices introduced by our program. Wherever possible, we place a bat house nearby. As program manager, I try to visit every site to personally supervise



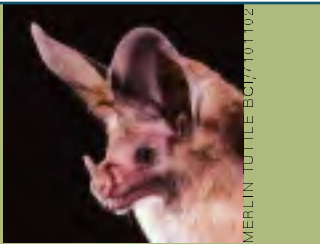
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Lois Blumenthal works with Caribbean Utilities Co. Ltd. to place bat houses around Grand Cayman. CUC provides the utility poles and equipment used for the installations.

exclusions. My presence is becoming less necessary as Truly Nolan, our largest pest-control company, has committed to using only our recommended exclusion methods.

In Cayman, bat houses do much more than provide shelter for important native wildlife. They help win new friends for bats across the islands. Bat houses offer a welcome option for people struggling with bats in their roofs, and many homeowners tell us that having a bat house in their garden reduces insects and livens up conversation when the bats come pouring out in the evenings. Bat houses also anchor education programs for both children and adults.

Our unique bat-house design, modified from BCI plans by local carpenter Ron Moser, is actually two “standard nursery houses” placed back-to-back with a single roof and a channel in the center that fits neatly over the top of a utility pole.



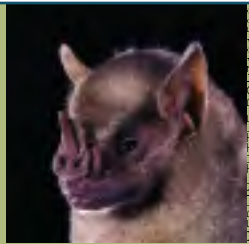
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Waterhouse's leaf-nosed bat
Macrotus waterhousii



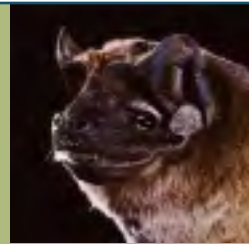
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buffy flower bat
Erophylla sezekorni



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Jamaican fruit-eating bat
Artibeus jamaicensis



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Pallas's mastiff bat
Molossus molossus



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Cuban fig-eating bat
Phyllops falcatus



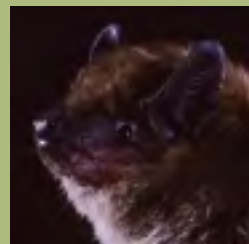
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eastern red bat
Lasiurus borealis



©MERLIN TUTTLE BCI/03391202

Mexican free-tailed bat
Tadarida brasiliensis



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big brown bat
Eptesicus fuscus



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Cuban fruit-eating bat
Brachyphylla nana

Bats of Cayman Islands

Mounting for the CUC crew is a simple matter of fitting the bat house onto the pole like a hat and then running a few bolts through the landing pads.

Our bat houses had been built by prison inmates, the government Public Works Department and volunteer carpenters. But thanks to the recent collaboration with Marriott Beach Resort, we have again improved the design and are building 50 more bat houses, doubling the current number.

The Marriott's donation of materials, as well as employee time and expertise, has a value to the conservation work that exceeds actual expenditures. This is a high-profile, low-cost donation with visible and concrete benefits.

Bryan Badrick, Chief Engineer at the Marriott Beach Resort in Grand Cayman, made additional modifications so the space between the paired houses provides homes for woodpeckers and parrots. His staff even paints decorative birds and bats on the houses. The sections that shelter bats are painted dark for extra warmth, while the bird area is a lighter shade for cooler inside temperatures. This design has already proved successful for West Indian woodpeckers, and we hope the beloved and colorful Cayman parrots will also find safe homes in the structures.

As part of the Know Your Islands Program, the National Trust holds interpreted "fly-outs" as bats emerge for a night of hunting insects. We explain the benefits of tropical bats and serve bat-dependent drinks and snacks while people watch hundreds of Pallas's mastiff bats swoop from their lofty home and disappear into the sunset. Both the Marriott and the Ritz-Carlton now have their own bat houses, and the program is providing informative literature and interpreted "fly-outs" for hotel guests and tourists.

The Marriott decided to throw its support to the program after learning "to appreciate the ecological importance of bats to the ecosystems of our country," said Laura-Ann Howard of the Marriott Grand Cayman Beach Resort. "Marriott supports combating the bat-roosting issues we face in roofs, especially in the tropics, with a true long-term solution that is eco-friendly and benefits humans directly – especially in regard to insect pest control – and that means bat houses."

Meanwhile, Truly Nolan and the Ritz-Carlton Grand Cayman, are co-sponsoring publication of *Cayman Islands' Bats Study Guide*. Every teacher in every school in the country will receive a copy of this important resource, produced by the National Trust and integrated into the nation's education curriculum. It is now also included in the Ritz-Carlton's Jean-Michelle Cousteau Ambassadors for the Environment Program.

Most schools on Grand Cayman have a bat house perched on a pole at the edge of their grounds. With the new study guide and classroom presentations by National Trust staff and volunteers, it's easy to see why Cayman Islands' children are among the most knowledgeable in the Caribbean about the many benefits of bats.

Solid research underpins most effective conservation and public-education efforts, and Cayman

Airways has been providing air transportation for scientists conducting important research on bats and other fauna and flora since 1997. This again illustrates the wisdom of matching donations to the donors' abilities and resources to maximize the benefits to the program in relation to actual expense of the business.

The contributions of these five companies, as well as various government departments (Environmental Health, Planning, Public Works, Education and Department of Environment) underlie the continued effectiveness of the program. We would like to see our successes, especially the Bat House Project, repeated throughout the tropics. Every country has a utility company, and Marriott Resorts, a company committed to contributing to the communities in which they are located, operates worldwide.

The opportunities for bat conservation are enormous. I would be delighted to share what I've learned and provide written resources that can be modified to meet the needs of each island or nation.

LOIS BLUMENTHAL is Director of the Bat Conservation Programme for the National Trust for the Cayman Islands. www.nationaltrust.org.ky. Email her at info@caymanwildlife.org. Visit www.caymanwildlife.org to download a free PowerPoint presentation. Join the Caribbean and tropical bat conservation e-group at Caribbean-bats@yahoo.com

The author thanks Merlin Tuttle, BCI Trustee Annie Band and BCI for 15 years of assistance, and Frank Roulstone, General Manager at the National Trust, Carla Reid, Chairman of the Trust Council, and the National Trust staff, especially Marnie Laing, Paul Watler and Catherine Redfern.



COURTESY OF LOIS BLUMENTHAL

Students at a school on Grand Cayman present a program extolling the benefits of bats. Every teacher has a copy of the *Cayman Islands' Bats Study Guide*, thanks to the National Trust and partners Truly Nolan and the Ritz-Carlton.

URBAN BATS OF BRAZIL

How bats survive when cities invade the forest

by Monik Oprea



The great fruit bat was the dominant bat species that the author found throughout the urban landscape of Vitória, Brazil.

Bats around the world are losing habitat to ever-expanding cities. Urbanization is more complete and irreversible than other encroachments, such as agriculture, and causes some of the greatest local extinction rates. Not only is natural habitat reduced to small, often tiny, remnant patches, but native plants are replaced with often-invasive nonnatives. The result is an ecosystem that becomes increasingly fragmented and homogenized as you move from rural areas to the urban center.

Some bat species adapt and survive in an urbanized environment, roosting in buildings, for instance, and foraging at streetlights. Others, especially those with specialized behaviors, do not.

Tropical forests are not immune to urban sprawl. The great Atlantic Forest that stretches along much of Brazil's eastern coast is a "biodiversity hot spot" that once covered 476,000 square miles (1.2 million square kilometers). Today, just 8 percent – about 38,600 square miles (99,900 square kilometers) – remains intact. What once was forest is home now to about 70 percent of Brazil's 169 million people.

The southeastern state of Espírito Santo, where little is known of local bat diversity and ecology, is growing so rapidly that we must increase our knowledge of native bats in order to create and implement conservation and management plans



Barren, non-wooded streets, such as this one in Vitória, were almost completely devoid of any bat activity.

before it is too late. The capital city of Vitória was founded in 1551 on an offshore island, but urbanization was insignificant until the 1940s. In the '60s, the city spread onto the mainland as industrialization expanded. Its population is estimated at 1.8 million people, and the city is listed as a high-priority site for biodiversity conservation.



COURTESY OF ROBSON SOARES DA COSTA

After collecting a *Maclura tinctoria* fruit, this great fruit bat moves deeper into the city park in Brazil. The bat feeds at the fruit tree despite the artificial light and walking path.

I chose Vitória to study the complex relationship between urbanization and biodiversity and the general urban ecology of bats. I examined habitat uses and needs of various species and bats' use of urban parklands and wooded and non-wooded streets. The research was supported in part by a BCI Student Research Scholarship funded by the U.S. Forest Service International Programs.

The city has eight municipal parks where forest remnants can provide a refuge for wildlife. For our study, we chose three parks ranging in size from about 5.5 acres (2.3 hectares) to 25 acres (10 hectares) for sampling. We also sampled three wood-



COURTESY OF MONIK OPRERA

Urban parks, although typically only small, altered remnants of natural forest, offer roosting and foraging resources for many bat species. This park is just 5.5 acres (2.3 hectares).

ed streets (bordered by trees and other plants) and three non-wooded streets. Researchers have reported that wooded thoroughfares can serve as corridors along which birds move from park to park in an urban landscape. Do these streets also serve as pathways for bats?

We conducted a total of 31 netting sessions between August 2006 and July 2007. At each session, we monitored mist nets at all sampling sites for four hours beginning at sunset. We recorded each captured bat by species, sex, age, reproductive status, weight and dimensions. Fecal samples were collected for later analysis, and each bat was banded before release.

We captured a total of 172 bats representing 10 species in four families. By far the most common species was the great fruit bat (*Artibeus lituratus*), with 114 captures. This was the only species netted along non-wooded streets. We also observed several bats of the *Noctilionidae* family (known as bulldog bats) feeding over a small parkland lake and under a bridge, but captured none.

Urban parks, despite their modest size and visitation by people, were the overwhelmingly favored habitat. All 10 species and 71 percent of the bats in our sample were netted at the parks, which typically offer native trees (although usually with nonnatives, as well), small lakes and other resources.

Only two species, 40 great fruit bats and six white-lined broad-nosed bats (*Platyrrhinus lineatus*), were captured along wooded streets for 27 percent of the total. Barren streets produced only three great fruit bats.

We also identified several day roosts of these two species in trees on the campus of the Federal University of Espírito Santo, near the sampling areas.

Fruit-eating bats completely dominated our sample with 81 percent of captures. These included great fruit bats, white-lined broad-nosed bats and big-nosed tent-making bats (*Uroderma magnirostrum*). Flying insect-eating bats, gleaning insectivores, nectar-eating bats and omnivores each accounted for 6 percent or less.

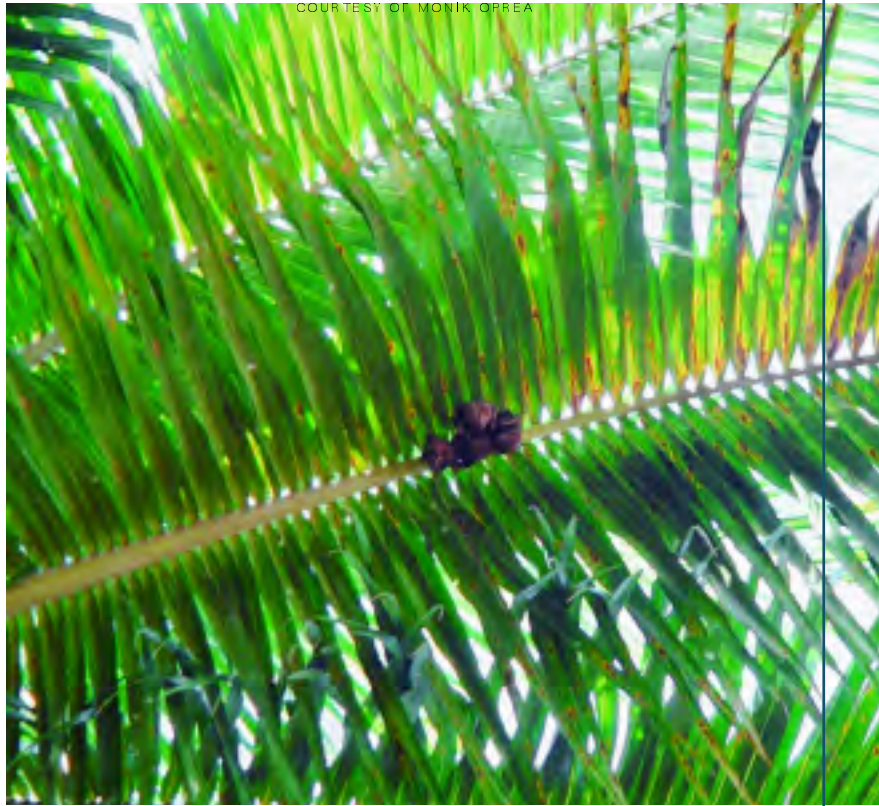
It is quite possible that flying insectivores, such as those often reported around streetlights, are underrepresented because of the limitations of mist netting. Insect-eating bats frequently fly at higher altitudes than other bats and their especially sophisticated echolocation makes them better able to avoid the nets. The relative scarcity of these bats may also reflect our sampling locations and foraging preferences of urbanized insectivores.

The diversity I found in Vitória clearly falls well short of that in the intact forests of Espírito Santo, in which 36 species have been recorded. Comparing bat diversity of forests and urban areas is difficult, however, because so few forest areas have been systematically sampled. My previous research at Espírito Santo's Paulo Cesar Vinha State Park recorded a total of 15 species.

These results confirm previous studies that find sharply decreased species richness and abundance in urban landscapes compared to less-disturbed areas. It also appears unlikely that wooded streets offer bats the same park-connecting corridors as reported for birds. The Vitória sample indicates that for bats, tree-lined streets are, statistically, much more similar to non-wooded streets than to urban parks. Only two bat species used them, both in low numbers.

These data also suggest that the amount and complexity of vegetation likely play a large role in maintaining the abundance and diversity of bats.

This urban bat population, like others reported elsewhere, is dominated by a single species, the great fruit bat, which



Great fruit bats found roosting space in palm trees on the campus of the Federal University of Espírito Santo. A number of white-lined broad-nosed bats were also found roosting on campus.

apparently has a high tolerance for urbanization and a strong ability to adapt to changing conditions.

We also reported the first observation (published in *Biota Neotropica*) of this species feeding on *Maclura tinctoria* (fustec wood) fruits, which adds a new item to the known diet of this important seed-dispersing species. These fruits have large seeds that are not swallowed by the bats, which instead eat the pulp and discard the seeds. A diet of fruits with large, uneaten seeds may indicate an important resource that is not detected in traditional diet studies that evaluate fecal samples.

The only species in our study that had not previously been reported in urban areas of Brazil is the silver-tipped myotis (*Myotis albescens*).

I hope this contribution to the knowledge base of urban ecology can help conservation efforts in the cityscapes where increasing numbers of bats find themselves forced to adapt or die. Sound ecological principles, such as preserving remnant natural habitat, restoring native plant species to modified habitats and using native trees and more of them along streets and boulevards, can help at least some bats and other wildlife to survive the growth of cities.

MONIK OPREA is a graduate student in Biology at the Federal University of Espírito Santo in Brazil.

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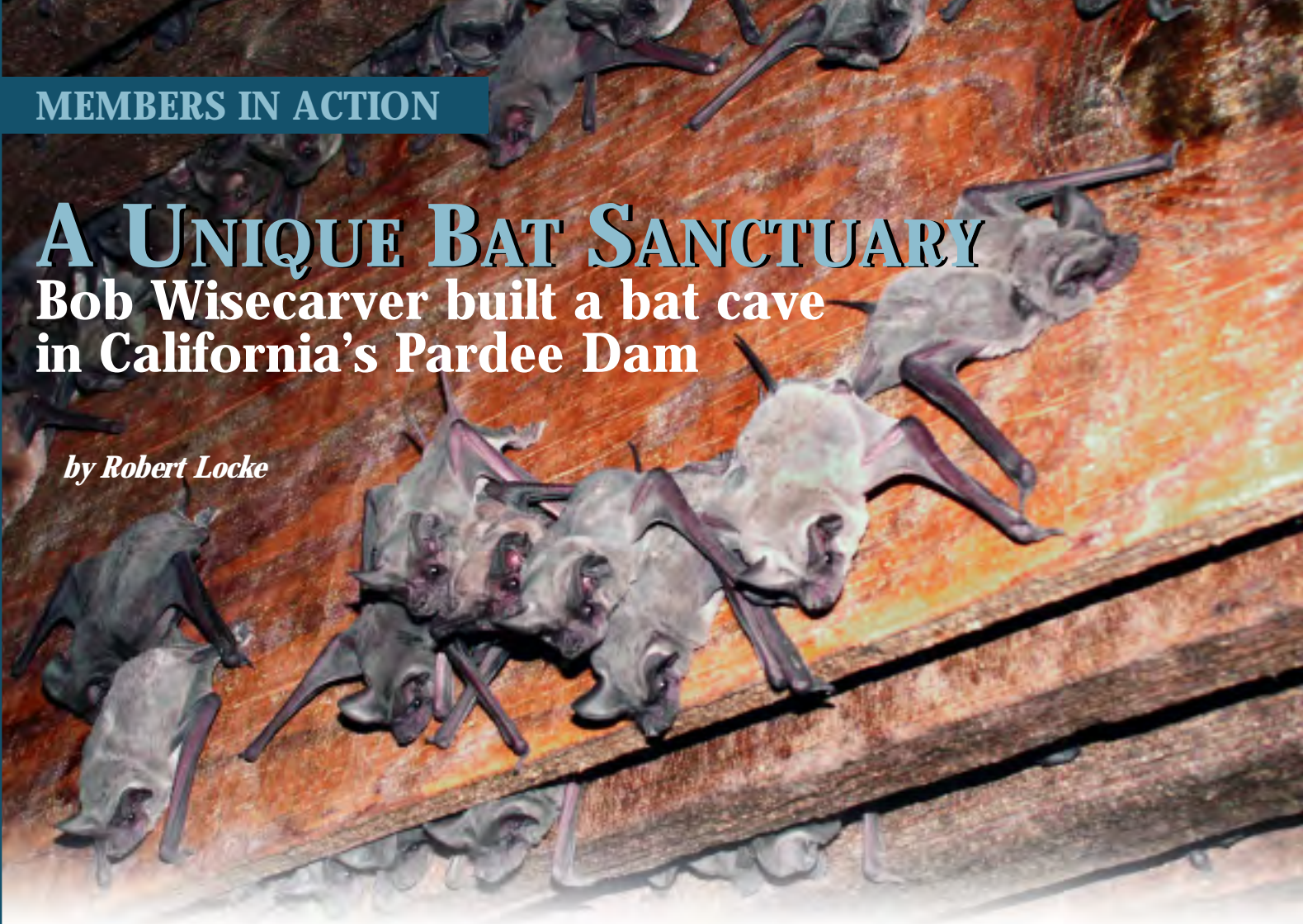
White-lined broad-nosed bats were netted along wooded thoroughfares, but never along non-wooded streets. This was the second most numerous species the author captured in Vitória.

A UNIQUE BAT SANCTUARY

Bob Wisecarver built a bat cave in California's Pardee Dam

by Robert Locke

COURTESY OF BOB WISECARVER



Bob Wisecarver's bat houses are a bit like snowflakes: No two are ever exactly alike, with each designed to meet specific needs and to utilize the mostly salvaged materials he converts to abodes for bats throughout northern California. But his most unusual creation is a unique and extremely successful "bat cave" that provides a home for some 9,500 bats in the spillway of the Pardee Dam across the Mokelumne River.

The 86-year-old Walnut Creek resident, known as "Bat House Bob," retired years ago from a career as a problem solver in the construction business. "My job," he says, "was to check out a problem, go back to the office and come up with a solution, ... then take it out to the job site and install it. That is exactly what happened at Pardee."

In 1995, the East Bay Municipal Utility District sealed several openings in a spillway during renovations of the 75-year-old dam, some 30 miles (50 kilometers) northeast of Stockton, California. That displaced a small colony of Mexican free-tailed bats (*Tadarida brasiliensis*) that had been living inside the dam, so EBMUD turned to Wisecarver for help in providing a new home for the bats.

He was a logical choice. Wisecarver has been a remark-



COURTESY OF BOB WISECARVER

Mexican free-tailed bats (top and above) now overflow the roosting structures Bob Wisecarver built in this chamber of the Pardee Dam in northern California. A much smaller bat colony was displaced when the dam was renovated in 1995.

ably active bat-house builder and advocate since encountering a copy of *BATS* magazine in 1993. The issue featured an article about an Oregon organic farmer, Tony Koch, who built bat houses to attract bats that helped control corn earworm moths. Wisecarver met with Koch and “he put a fire in my belly. What really got me going is that you can help solve these problems without using poisons.”

He started out with plans from BCI’s *Bat House Builder’s Handbook*, then added special touches based on his own observations and insight. His distinctive – and usually successful – bat houses were already scattered around the area when EBMUD came calling.

Wisecarver and an EBMUD engineer visited the dam to figure out a solution. An initial notion to simply install a few bat houses in one of 16 concrete, cubicle-like spaces in the spillway was dismissed as inadequate. Wisecarver decided to turn one of the cubicles, each 10 feet (3 meters) high, wide and long, into a bat roost – “an instant bat cave.”

They assembled five roosting modules similar to those often used now under bridges, basically 5-foot-long (1.5 meter) rectangular boxes divided by parallel panels to form roosting chambers. “They were all 10 inches (25 centimeters) high because that’s what I had in the way of fence boards, but they were all built differently,” Wisecarver said. “All the houses had different spacing, as we didn’t know what kind of bats we would get and what they liked best.”

This was in the very early days of BCI’s pioneering North American Bat House Research Project, which began in 1992, and reliable information was still sketchy at best. Wisecarver was an important part of changing that, as he has contributed observations and data as a project Research Associate since 1995.

Four of the modules used rough lumber for roost-chamber walls, while another tested the idea of using carpet scraps instead. (Wisecarver said the carpet worked well enough, but required frequent replacement because of odor issues.)

The wide-open front of the cubicle was closed off by a plywood wall with a door and three 6-inch (15.2-centimeter) by 18-inch (45.7-centimeter) openings for the bats.

The Pardee bat cave got off to a slow start, with few bats moving in and most of those scrunching behind the wall framing rather than in the roosting chambers. So Wisecarver built an extension that created three-quarter-inch (1.9-centimeter) chambers on one of the modules. “That worked well, so we reworked another one, and they liked it, too.”

He has been gradually replacing the original roosting modules with three-quarter-inch chambers and also adding new ones ever since. “We have been adding four panels a year for quite some time to keep up with our growing population,” he said.

The bats in residence are overwhelmingly Yuma myotis (*Myotis yumanensis*) and Mexican free-tailed bats.

In 2000, all of the bats, estimated at nearly 3,000, abruptly vanished. The culprit turned out to be a barn owl, an efficient predator of bats that had moved into the roost. After



Bob Wisecarver (right) and a helper at the Pardee Dam during the original construction of the “bat cave” about 12 years ago.

running the owl out, Wisecarver put wooden bars over the three wall openings that were intended only for bats. That reduced the entrances from 6 inches to about 2 inches (5.1 centimeters), which kept the owl out, although the bats didn’t return until the following spring. “So one thing we learned,” Wisecarver said, “is that no opening can be more than 2½ inches (6.4 centimeters) high.”

Three years ago, he realized that during the warmest summer months, the roost chambers got so hot that many of the bats were hanging on the outside of the modules. Deciding that “we needed to cool things off, we cut two vents into the top of the front panels as hot-air vents. The next year, there were fewer bats showing, but there was an increase in guano, indicating more bats in the roost. Voila! It seemed to work. Now we plan to add more vent slots and more panels.”

He and several volunteers also annually collect the guano (195 gallons [0.74 cubic meters] in August) that the bats leave behind. The guano fertilizes gardens at a historic site alongside the Pardee Reservoir.

The bat population keeps growing, and Wisecarver keeps tinkering and improving things at the dam and dozens of other California bat-house sites. But now, he says, it’s about time to retire from the career that has filled his retirement.

“I have a deep sense of pride in my gut for this whole thing,” Wisecarver said. “Bats are only half of what I do. The rest of my free time is spent on habitat enhancement at our four Open Space Parks in Walnut Creek.

“But as the saying goes: All good things must end. This will probably be my last year in this monkey business. On my last trip in August, all I did was stand around and watch.”

So he says he’s looking now for someone to take the baton and continue the program he began so long ago. But if you ever wonder whether one person can make a difference, look no further than Bat House Bob Wisecarver.

Saving bats from barbed wire

Thousands of Australia's largest bats, mostly flying foxes, die slow, painful deaths each year after becoming snagged and entangled on the barbed-wire fences that spread around much of the nation's farms and rangelands. Carcasses of other wildlife, especially gliders (possum-like marsupials that glide like flying squirrels), also are found dangling from the wires. The problem is so widespread that conservation groups have despaired of achieving any real progress.

But now, says Jenny Maclean of the Tolga Bat Hospital in northern Australia, "There seems to be a critical mass of energy to tackle the issue and start the long process of replacing barbed wire with wildlife-friendly fencing."

The Wildlife-Friendly Fencing Project, with a lead grant from the World Wildlife Fund, reports considerable progress since its official launch in September 2006. BCI's Global Grassroots Conservation Fund is supporting production of an educational video to document the extent of the problem and demonstrate cost-efficient alternatives. The Bat Hospital is coordinating the national effort with a growing list of partners.

Among bat species that fall frequent victim to the fences are the spectacled (*Pteropus conspicillatus*) and gray-headed flying fox (*P. poliocephalis*) and the Australian ghost bat (*Macroderma gigas*), all listed as threatened.

The project's educational campaign is now up and running, and its activities and goals have been reported by newspapers, magazines and radio stations around the country and beyond. A brochure will be ready for distribution before the year is out.

Volunteers running the project are seeking landowners willing to modify their fences and demonstrate the feasibility of using safer fencing for a broad range of needs and terrains.

Recently developed wildlife-friendly fencing guidelines are built around two strategies: removing or replacing the barbed wire and improving its visibility. Most bat kills involve the top strand of fencing, so replacing it or dramatically increasing its visibility with streamers or fence tape can save bats and other wildlife.

One initial success involves not barbed wire but the almost invisible monofilament netting that is often thrown over backyard fruit trees.

Such netting causes horrific injuries to flying foxes. Most leading outlets that sell the netting recently agreed to discontinue it and instead provide much safer white, knitted netting, along with advice about stretching the nets to further reduce the risk to bats.

Maclean notes that the scope of the Wildlife-Friendly Fencing Project is enormous, and change will only come – slowly – through convincing landholders that they can effectively fence their property without endangering wildlife.

To help Bat Conservation International's Global Grassroots Conservation Fund continue its support of this important initiative or to contribute to Global Grassroots' efforts around the world, please contact development@batcon.org



COURTESY OF TOLGA BAT HOSPITAL

Conservation in India

Grace Trust, a nonprofit group dedicated to empowering women and children in India, added bat conservation to its agenda this year. The Trust developed bat-education materials, explained the importance and needs of bats to key women and students, held rallies and presented community slide shows in the Madurai area of southern India. The new direction was supported by a BCI Global Grassroots Conservation Fund grant, which was made possible by the generosity of BCI Member Janet Willis.

The program began with a training session on the importance and methods of bat conservation for 150 women representing 50 women's forums around the region. A university professor and a wildlife-conservation expert led the session. Study materials were distributed, and myths that have been extremely harmful to Indian bats were dispelled. The goal is for these women to return to their communities and neighborhoods equipped to spread the word about bat conservation.

After the workshop, the women participated in a bat-conservation rally that drew 5,000 spectators.

Recognizing the great, long-term payoffs in educating children, Grace Trust sent two experienced conservationists to introduce 250 students from schools throughout the area to the values of bats and the critical need for conservation. The educators noted the needless killing of bats for commercial pur-



COURTESY OF GRACE TRUST

Women rally for bat conservation in Madurai, India. The event was supported by BCI's Global Grassroots Conservation Fund.

A most unusual photo

Kimberly Thoman was standing on the patio of her home in Parker, Colorado, at about 8 p.m. on October 2, when two noisy airborne bats almost crashed into her in their apparent haste to land. The pair wound up on a branch of a honey locust tree, about six feet (two meters) off the ground, where they proceeded to mate.

Kimberly and her husband, Brian, who grabbed his camera, watched the bats for about 10 minutes, during which he took this remarkable picture – the only photo ever taken of mating hoary bats (*Lasiurus cinereus*). It may also be the strongest suggestion yet that hoary bats, like eastern red bats (*Lasiurus borealis*), may actually begin the act of mating in mid-air. Red bats have been seen flying in tandem while apparently copulating and have occasionally been reported falling to the ground prior to completion.

Brian Thoman said darkness prevented his wife from determining whether the two bats were already mating in flight or just flying together before their hurried landing. She heard loud vocalizations during the flight, but not after the landing.

"I told Kimberly that I'd bet nobody had seen this before," Thoman said. "I realized the photo could be useful to researchers." He contacted BCI for information.

"That photo," said biologist Paul Cryan of the U.S. Geological Survey in Fort Collins, Colorado, "is the best evidence of nocturnal aerial courtship and mating in hoary bats that we have ever seen and is suspiciously similar to observations made on eastern red bats."

He said there are only two previously known observations



COURTESY OF BRIAN THOMAN

of mating hoary bats, both on the remote Southeast Farallon Island in the Pacific Ocean, about 30 miles (42 kilometers) west of San Francisco. Cryan has been helping to study hoary bats that use the island as a stopover during migrations.

He said that while bat species display a great diversity of mating behaviors, specifics are documented for very few, probably less than 10 percent.

Cryan noted that hoary and eastern red bats both roost in trees or foliage much of the year and make significant migrations in the spring and again in the fall. Both species live largely solitary lives during the summer and appear to mate in the fall, possibly during migration.

Hoary and red bats also are among the most commonly killed species at wind-energy facilities. "I'm going out on a limb here and suggesting that aerial mating by hoary and eastern red bats might have something to do with their susceptibility to wind turbines," Cryan said.

He said most wind-turbine fatalities of these two species occur during the fall mating period, with significantly fewer reported during the spring migration. Flocking behavior has been reported in both species during late summer and early fall. Cryan's hypothesis suggests that red and hoary bats, searching for mating partners during the fall migration, may use the tallest trees on the horizon as gathering points where they begin courtship and mating. Tall trees are both easy to find and typically provide extensive roosting options.

The problem occurs, Cryan suspects, when the tallest "trees" around turn out to be wind turbines.

poses and traditional medicines, and stressed that young people can have an important role in conservation. Participants, armed with age-appropriate study materials, pledged to carry the bat-conservation message back to their schools. Teams also introduced bat-conservation programs directly to 10 schools.

In addition, 60 students with strong leadership potential were taken on a field trip into the foothills of nearby Sadurakri Mountain for a close-up look at roosting bats – and at the damage done by commercial hunters of bats. The role of bats in maintaining healthy ecosystems and economies became much clearer for young people after seeing bats in their natural homes.

A Cycle Rally for Bat Conservation, with 60 youngsters bicycling 15 kilometers (9.3 miles) on behalf of bats, drew as many as 10,000 spectators, who were exposed to the idea of protecting India's bats.

A post-project assessment found that the programs were well received and some attitudes were changed, although much work remains. Grace Trust hopes to build on this year's experience and expand bat conservation as part of their greater mission.

Grace Trust is requesting another BCI Global Grassroots Conservation Fund grant (of \$4,975) to extend the bat-education program to college students, rural families and farmers and to provide bat-watching field trips for key groups. To help, please contact development@batcon.org.



Indian students examine a bat colony during a field trip.

COURTESY OF GRACE TRUST

Apply for BCI Scholarships

Bat Conservation International invites students at universities worldwide to apply for its 2008 Student Research Scholarships.

Young scientists around the world are conducting original, conservation-relevant research – and honing skills for the future – with support from BCI’s Student Research Scholarships. Since 1990, this program has invested more than \$550,000 to help support research by 237 students in 51 countries. Students, selected on the basis of a review by outside experts, receive scholarships of \$2,500 to \$5,000 each for research that enhances bat conservation. BCI Scholars have added significantly to our knowledge of bats, their values and conservation needs, and many are now leaders in science and conservation.

BCI’s partnership with the U.S. Forest Service International Programs, now in its second year, has greatly expanded the program and increased the size of awards. Thanks to this collaboration, we are now providing 10 additional scholarships annually for work in developing countries. For the current academic year, BCI is supporting 21 projects in 13 countries.

For the first time this year, the U.S. Forest Service International Programs and Travis and Bettina Mathis are jointly supporting a program that offers graduate students the opportunity to double their award (\$5,000 - \$10,000) if they focus their research on subjects chosen by BCI as having special value to bat conservation.

This year’s Special Scholarships are restricted to research on bats’ pollination of Old World mangroves or durian. Anecdotal observations suggest that both are highly reliant on bats for pollination. The durian is the most commercially valued fruit in much of Southeast Asia and nearby Pacific Islands, but farmers often mistakenly assume that bats reduce (rather than enhance) durian production. Coastal mangroves are ecologically essential but are disappearing at alarming rates. Their primary bat pollinators are also disappearing rapidly but remain largely unrecognized as essential elements in mangrove-conservation planning. Studies documenting the role of bats as durian and mangrove pollinators are urgently needed.

For more information, a list of current BCI Scholars and their research, or to apply for 2008 BCI Student Research Scholarships, please visit BCI’s website at www.batcon.org. BCI Scholarships are listed under the heading “BCI Grants.” The deadline for applications is December 15, 2007.

BCI is also accepting applications for its North American Bat Conservation Fund grants, competitive awards of up to \$5,000 each to support conservation and conservation-related research in the United States, Canada and Mexico. The application deadline is also December 15.

The BCI Global Grassroots Conservation Fund accepts applications year-round for grants aimed at helping locally initiated conservation efforts outside North America, especially in developing countries.

A new bat stamp

The U.S. Postal Service needed 155 years (and the encouragement of BCI Member Carol Adams of Medina, Texas) to finally put pictures of bats on postage stamps. The very first were introduced in 2002. Now, just five years later, there’s a new U.S. stamp bearing the image of a lesser long-nosed bat pollinating a saguaro cactus.

The new stamp is included in the four-stamp Pollinator set issued during National Pollinator Week this past summer. The set, said Postmaster Yverne Pat Moore, provides “a special way to honor the beauty that is in our midst each day. The animals featured on the stamps are beautiful ambassadors of nature.”

The set features four wildflowers and four pollinators. In addition to the lesser long-nosed bat (*Leptonycteris yerbabuena*), two Morrison’s bumblebees are paired with purple nightshade; a calliope hummingbird sips from a hummingbird trumpet blossom; and a Southern dogface butterfly visits prairie ironweed.

The 2002 American Bat Stamps featured four photographs

by BCI Founder Merlin Tuttle. Adams, by the way, got that ball rolling by showing a BCI bat poster to a member of the Postal Service’s Citizens Stamp Advisory Committee and declaring that bats “are wonderful, they have precious faces and they need the help.”

For the Pollinator Stamps, artist Steve Buchanan created an intricate graphic that emphasizes the relationship between pollinators and plants and hints at the biodiversity that’s required to continue that crucial relationship into the future.

Pollination is the basis for fruit and seed production. Human economies depend heavily upon pollinators and, the Postal Service notes, some animal pollinators

appear to be declining.

The lesser long-nosed bat, found in southern Arizona and southwestern New Mexico and in Mexico, is listed as endangered in the United States. It feeds on the fruit and nectar of night-blooming cacti such as saguaro and organ pipe, as well as that of many species of agave.



A young actor puts bats in the spotlight

Chandler Frantz takes time out now and then from his dual careers as a student and theater and television actor to teach classmates and others about the benefits of bats. His sophisticated PowerPoint presentations, like the one pictured here, are especially impressive when you consider Chandler is a very busy 9-year-old in the third grade at the Academy Hill School for the Bright, Curious and Gifted in Springfield, Massachusetts.



COURTESY OF STEPHEN FRANTZ

The youngster, meanwhile, is making a name for himself as an actor, a goal he set at age 4. He had a featured role this September in the pilot for the ABC series “Dirty Sexy Money” and was a lead in “All the Way Home” last fall (Off-Broadway). He has also appeared, and still appears, in TV commercials.

But he also makes time to celebrate bats. “I really appreciate bats because they help the Earth (including eating lots of insects) and once you get to know them, bats are cute and very interesting,” Chandler explains.

He comes by his interest in bats naturally. His father, Stephen Frantz, was for many years a research scientist at the New York State Department of Health, where he worked tirelessly to correct misinformation about bats and rabies and to encourage humane exclusions from buildings. He’s now Principal Officer of Global Environmental Options, LLC, a research and advisory organization concerned with ecologically sound pest management and related issues.

Frantz and BCI Founder Merlin Tuttle have worked together on these issues since 1982. The family took Chandler to see the famous bat colony at the Congress Avenue Bridge in Austin, Texas, for the first time when he was just a year old.

Chandler said he develops his presentations with information from “my dad and his papers, a little bit of computer work (Google searches), Merlin Tuttle’s book, *America’s Neighborhood Bats*, and talking with Merlin himself.”

The effort seems to be paying off. Chandler says some of his friends have become fans of bats.

BCI member snapshots



COURTESY OF ANIQUE PRIDE

BCI Member Christine Blondeau is a zookeeper at the Memphis (Tennessee) Zoo, where she works mostly with bats in the “Animals of the Night” exhibit. This is Pippi, a baby Egyptian rousette fruit bat (*Rousettus aegyptiacus*) that is being raised by hand at the zoo. “A lot of people do not associate the word ‘cute’ with bats,” she says, “but I think this picture would change some minds.”

Share a snapshot of your bat activities with your fellow members: Send it to Robert Locke, Bat Conservation International, PO Box 162603, Austin, TX, 78716.

The WISH LIST

Your help with any of these special needs will directly improve BCI’s ability to protect bats and bat habitats. To contribute or for more information, contact BCI’s Department of Development at (512) 327-9721 or development@batcon.org.

Rebuilding a rare colony

An abandoned farmhouse in Suffolk County, Virginia, was once a very important roost for rare Rafinesque’s big-eared bats, which are rapidly losing their natural forest habitat. Rafie colonies typically number 10-40 bats. This one totaled more than 100 – until the aging farmhouse began to collapse. Now only a handful of bats remain. Researchers Ela Carpenter and Rick Sherwin of Virginia’s Christopher Newport University, who identified the conservation value of this site, have the owner’s permission to repair part of the remaining structure specifically to accommodate Rafinesque’s big-eared bats and restore the colony. Results will be monitored. BCI is partnering with Carpenter and Sherwin. The project, which begins this fall, will cost \$3,000.

Hauling for Bracken

BCI’s Bracken Bat Cave and Nature Reserve promises to become the most effective bat-education site in the world, a place where visitors will explore nature and watch in awe as 20 million bats emerge from the San Antonio-area cave. But achieving that long-nurtured dream requires an enormous amount of work. We are restoring the 700 acres of rugged Texas Hill Country by clearing invasive cedars and nonnative plants, seeding appropriate savannah grasses and laying out interpretive trails. This requires hauling equipment and materials into the property and removing huge loads of debris. Bracken Coordinator Fran Hutchins needs a heavy-duty, 14-foot trailer with a double axle and dumping system. The price tag is \$8,873.

Champion pollinators

Readers of *BATS* magazine might be familiar with the important research by Nathan Muchhala into the evolutionary links between plants and the bats that pollinate them. See “The Ties that Bind Bats & Plants” in the Summer 2005 issue and “A New World Record” in Winter 2006. That work, supported by a BCI Student Research Scholarship, helped Muchhala earn his Ph.D., and now he’s beginning a post-doctoral fellowship at the University of Toronto. He hopes to continue his research in Ecuador, this time studying the differences between bats and hummingbirds as pollinators of the same plant species. He suspects he will find that bats are the more efficient pollinators because their fur loses less pollen during flight between plants. Muchhala seeks a \$3,000 post-doctoral grant for this study.

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