Western Bat Working Group

WBWG NEWS

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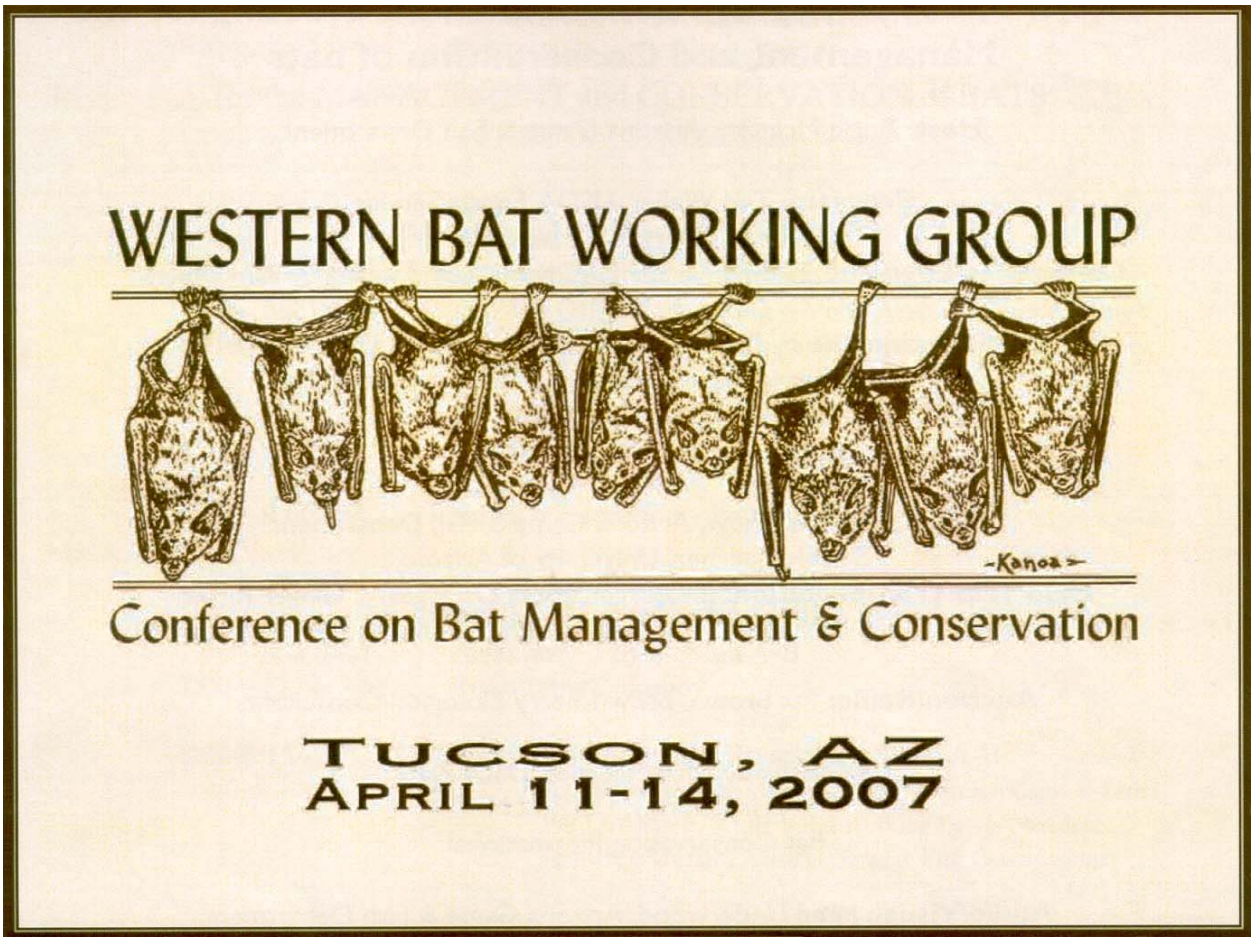

Conference Summary

Conference Photo Album

Conference Schedule and Abstracts

Poster Abstracts

Who's Who in the Western Bat Working Group

ABOUT THIS NEWSLETTER

WBWG News is published twice annually. The .pdf of this newsletter is available online at http://www.wbwg.org, or from your state/provincial representative; to receive notification each time a new issue is posted, please join the Listserv (instructions on home page). If you have news items you'd like to share with the newsletter, please contact the WBWG representative for your province/state (see listing at end of newsletter), or send an email directly to corilausen@netidea.com. We accept submissions at any time of the year! Thanks for making this networking opportunity possible.

Cori Lausen and Kristi DuBois, Newsletter Editors

Our thanks to outgoing officers Ted Weller, Mike Herder, and Alice Chung-MacCoubrey who are not returning for a second term.

These folks volunteered their time and shared their passion for bats so that all of us and the bats could benefit. We are grateful for their dedication and good work and look forward to continued interactions with them through the WBWG.

Pat Ormsbee

2007 CONFERENCE SUMMARY

The 2007 Conference was a great success! The conference had 122 registered participants - from state and federal agencies, universities, NGO's, and the private sector. Participants came from as far away as Alaska and Washington D.C. The conference basically 'broke even' financially. Six states donated a total of $6,000 dollars to WBWG, and fund-raising efforts at the conference (auction, raffles, etc.) generated an additional $2,200.
Oh, and a good time was had by all.

Brad Phillips, Treasurer

THANKS TO OUR CONFERENCE ORGANIZERS

Efforts of many helped make the conference a success, including: **Angie McIntire** (Host); **Ted Weller** (Program); **Kim Duffek** (Conference Logo); **Nancy Renison, Karen Franco, Ginger Ritter**, and **Aimee Hart** (Registration); **Tim Snow** and **Debbie Buecher** (Field Trips); **Bill Burger, Elissa Ostergaard, Ginger Ritter, Jared Underwood, Lin Piest**, and **Susan MacVean** from Arizona Game & Fish (Field Trip Transportation); **Pat Brown** (Auction/Raffle); **Michael Herder, Erinn Shirley**, and **Bat Conservation International** (Website); **Jared Underwood** and **Jason Corbett** (Audio/Visual); and **Sandy Wolf** (Bats and Bridges Program Insert).

Special Thanks to: **Brad Phillips, Daniela Rambaldini, Dan Taylor, Pat Ormsbee, Toni Biaggio, and Trish Griffin.**

Special thanks to vendors and others for generous contributions to the Auction/Raffle: **Al Beck, Bat Conservation International, Binary Acoustic Technology, Brad Phillips, Bruce Taubert Photography, Deb Crouch, Henry Dupere Metal Designs, Holohil, John Bassett, Kim Livengood, Maberry Bat Centre, Mark Jensen, Mary Kay Clark, Patricia Brown, Speleobooks, Stevan Logsdon Jewelry, Susan Lenard, Trish Griffin.**

CONFERENCE PHOTO ALBUM

Amenities of the Hilton included bats roosting under the bridge.

A silent auction and great vendors provided additional entertainment.

Wine was a popular item in the live auction.

The field trips provided hands-on learning opportunities.

Thanks to Anthony Mann, Dan Baggao, Ginger Ritter, Greg Tatarian, and Dan Taylor for submitting pictures for this newsletter!

WESTERN BAT WORKING GROUP
2007 BIENNIAL MEETING for the MANAGEMENT and CONSERVATION of BATS
Tucson, Arizona

Wed. April 11, 2007

1:00 – 5:00 PM	California Bat Working Group – Conference Room II
3:30 – 6:00 PM	WBWG Officer's Meeting – Vista Area, 2nd floor lounge
5:30 – 7:30 PM	Arizona Bat Resource Group – Conference Room II
4:00 – 9:00 PM	Presentation Loading – Salon A-B
4:00 – 9:00 PM	Registration – Lobby
6:00 – 9:00 PM	No Host Reception – Poolside

Thur. April 12, 2007

7:00 – 8:00 AM	Breakfast – Foyer Salon A-B
7:00 – 11:00 AM	Registration – Lobby
8:00-8:15 AM	Welcome and Opening Remarks – Salon A-B Angie McIntire, Meeting Host, Arizona Game & Fish Pat Ormsbee, Western Bat Working Group President Jennifer Martin, Arizona Game & Fish Commissioner

Bats and Wind Energy
Moderator: Lisa Wilkinson, Alberta Bat Action Team

8:15-8:35 AM	Assessing the Impacts of Wind Turbines on Bats. Ed Arnett, Bat Conservation International, Austin, TX.
8:35-8:55 AM	Bats and Wind Energy Facilities in Southern Alberta: a case study. Erin Baerwald, University of Calgary, Calgary AB.
8:55-9:15 AM	Permitting Wind Energy Facilities and Accounting for Wildlife. Jim Lindsay, FPL Energy.
9:15-9:35 AM	Objectives, Uncertainties and Biases in Bat Mortality Studies at Wind Facilities. Wallace Erickson, WEST Inc. and Ed Arnett*, Bat Conservation International.
9:35-9:55 AM	BREAK
9:55-10:10 AM	An Overview of the Alberta Document: Bats and Wind Turbines. Pre-siting and Pre-Construction Protocols. Cori Lausen*, Erin Baerwald, Jeff Gruver, and Robert Barclay, University of Calgary.

10:10-10:20 AM	California Bat Working Group Bat and Wind Energy Guidelines. Bronwyn Hogan, California Department of Fish and Game
10:20-11:00 AM	Q&A/GROUP DISCUSSION
11:00-11:30 AM	How can WBWG contribute?
11:30-1:00 PM	LUNCH – On your own

Marking Migratory Bats

Moderator: Toni Piaggio, WBWG Vice President

1:00-1:20 PM	Making the Most of Destructive Sampling: Why We Should be Marking Migratory Bats. Robert Barclay, Jeff Gruver*, Erin Baerwald, Joanna Coleman, and Cori Lausen, University of Calgary
1:20-1:40 PM	Marking Bats Potentially Causes Injury and Disturbance: Is Marking Bats Worthwhile? Ronnie Sidner, Ecological Consulting, and University of Arizona, Tucson, AZ.
1:40-2:00 PM	Long-distance Movements of Nevada Populations of the Mexican Free-tailed Bat (*Tadarida brasiliensis mexicana*). Philip Leitner, St. Mary's College of California. ** Presented by Pat Brown, Brown-Berry Biological Consultants, Bishop, CA.
2:00-2:20 PM	The Trials and Tribulations of a Two-Year Marking Project with the Lesser Long-Nosed Bat (*Leptonycteris curasoae)* in Southern Arizona. Karen Krebbs*, Tim Tibbitts, Ami Pate, and Curtis McCasland, Arizona-Sonora Desert Museum, Tucson, AZ (KK), Organ Pipe Cactus National Monument, Ajo, AZ (TT, AP), Cabeza Prieta National Wildlife Refuge, Ajo, AZ (CM)
2:20-2:40 PM	Q&A/Discussion
2:40-3:00 PM	BREAK
3:00-3:30 PM	GROUP DISCUSSION
3:30-4:00 PM	How can WBWG contribute?
4:00-5:00 PM	**Poster Session** Foyer Salon A-B
5:00 PM	Meet for Field Trips to Sabino Canyon and Aqua Caliente Hilton Lobby (Return around 11:00 PM)

Friday April 13, 2007

Roosting Ecology

Moderator: Steve Langenstein, Oregon Bat Working Group

8:00-8:20 AM — Roosts of Allen's Lappet-browed Bat (*Idionycteris phyllotis*) in Northern Arizona.
Ben Solvesky* and Carol Chambers, Northern Arizona University, Flagstaff, AZ.

8:20-8:40 AM — Roost-site selection and potential prey sources after wildland fire for two insectivorous bat species (*Myotis evotis* and *Myotis lucifugus*) in mid-elevation forests of western Montana.
Nathan A. Schwab and Kristi L. DuBois*, University of Montana, Missoula, MT (NAS), Montana Fish, Wildlife and Parks, Missoula, MT (KLD).

8:40-9:00 AM — Surface and Spatial Roosting Patterns of Townsend's Big Eared Bats (*Corynorhinus townsendii*) in Nevada.
Samuel L. Skalak and Richard E. Sherwin, Christopher Newport University, Newport News, VA.

9:00-9:20 AM — Cave myotis bat *(Myotis velifer incautus)* Roost Monitoring and Protection on Fort Hood, Texas during 2005-2006.
Charles E. Pekins, PWE Natural Resources Management Branch, Fort Hood, TX.

9:40-10:00 AM — Break

Habitat Use by Bats

Moderator: Michelle Caviness, WBWG Secretary-elect

10:00-10:20 AM — Effects of Landscape Structure and Prey Availability on Insectivorous Bat Foraging Ecology.
Elizabeth M. Hagen* and John L. Sabo, Arizona State University

10:20-10:40 AM — Passive Acoustic Sampling to Differentiate Bat-use between Native Cottonwood Galleries and Non-native Saltcedar Groves in southern Arizona.
Debbie C. Buecher* and Ronnie Sidner, University of Arizona.

10:40-11:00 AM — Low-cost, Low-power, Long-duration Acoustic Bat Detectors.
Matthew J Heavner* and Carolyn E Talus, University of Alaska Southeast.

11:00-11:20 AM — Differential Use of Pinyon-Juniper Woodland Habitat by Townsend's Big-Eared Bats (*Corynorhinus townsendii*) in Pershing County, Nevada.
R. R. Ives, R. E. Sherwin*, J. Jeffers, S. L. Skalak, D. Dalton, and S. Wolf, Christopher Newport University (RRI, RES, SLK), Nevada Department of Wildlife (JJ), Wildlife Engineering (DD, SW).

11:30—1:30 PM — Hosted Lunch (WBWG business meeting and auction) --Salon C

Conservation Genetics

Moderator: Jennifer Newmark, Nevada Bat Working Group

1:30-1:50 PM — Beyond mtDNA: Nuclear Gene Flow Confutes Cryptic Species in Little Brown Bats (*Myotis lucifugus*).
C. L. Lausen*, I. Delisle, R.M.R. Barclay, C. Strobeck, University of Calgary, Calgary, AB (CLL, RMRB); University of Alberta, Edmonton, AB (ID, CS)

1:50-2:10 PM — What Can Genetics Contribute to Definitions of Subspecies and Migratory Groups of Brazilian Free-tailed Bats (*Tadarida brasiliensis*)?
Amy L. Russell, Arizona Research Laboratories, Tucson, AZ

2:10-2:30 PM — Non-Invasive Species Identification from Mixed-Species Samples Using Microarray Technology: An Overview of the Technology and its Practical Application.
Jan M Zinck*, Maarten Vonhof, Lorelei Patrick, Portland State University, Portland, OR (JMZ, LP); Western Michigan University, Kalamazoo, MI (MV).

2:30-2:50 PM — Break

Bats and Mines

Moderator: Jason Williams, WBWG At-large Officer

2:50-3:10 PM — Modeling hibernacula selection by Townsend's big-eared bat.
Mark A. Hayes*, Rob A. Schorr, Kirk W. Navo, and Rick A. Adams. University of Northern Colorado, Greeley, CO (MAH, RAA), Colorado Natural Heritage Program, Fort Collins, CO (RAS), Colorado Division of Wildlife, Monte Vista, CO (KWN).

3:10-3:30 PM — Management Issues of Bats and Mines on a Landscape Level.
Patricia E. Brown* and Robert Berry. Brown-Berry Biological Consulting, Bishop, CA.

3:30-3:50 PM — Colorado Bats/inactive Mines Project: or "Just what have we been doing all these years"?
Kirk W. Navo*, Tom E. Ingersoll, Lea R. Bonewell, Nancy LaMantia-Olson, Antoinette J. Piaggio, and Sophie R. Oglesby, Colorado Division Of Wildlife, Monte Vista, CO (KWN), UC, Berkley, CA (TEI), USGS, Fort Collins, CO (LRB), USDA/ National Wildlife Research Center, Fort Collins, CO (AJP), Colorado Division Of Wildlife, Denver, CO (LNO/SRO)

3:50-4:10 PM — A Bat Roost Survey Protocol for Caves and Mines.
Michael J. Herder* and Patricia C. Ormsbee, USDI Bureau of Land Management, Arizona Strip, St. George, UT (MJH), USDA Forest Service, Willamette National Forest, Eugene, OR (PCO).

4:10-4:30 PM — Efficiency and use of external survey techniques when monitoring for Townsend's big-eared bats (*Corynorhinus townsendii*) in Pershing County, Nevada.
Jonathan H. Warren*, Richard E. Sherwin, Christopher Ross, and Jason Williams, Christopher Newport University, Newport News, VA (JHW, RES), Bureau of Land Management, Reno, NV (CR), Nevada Department of Wildlife, Ely, NV (JW).

4:30-4:50 PM — Whistling in the dark: determining significance of individual abandoned mines within a landscape of complexity.
Richard E. Sherwin, Christopher Newport University, Newport News, VA.

5:00 PM — Depart for Social at Arizona-Sonora Desert Museum.
Hilton Lobby (Return around 10:00 PM)

Saturday April 14, 2007

Bat Conservation Strategies

Moderator: Trish Griffin, New Mexico Bat Working Group

8:00-8:20 AM — Six Years of Bat Research by the Northwest Bat Cooperative.
Michael J. Lacki, Michael D. Baker, and Henning C. Stabins*, University of Kentucky, Lexington, KY (MJL & MDB), Plum Creek Timber Company, Columbia Falls, MT (HCS).

8:20-8:40 AM — Predictive Modeling of Important Chiropteran Habitat in Utah.
Adam J. Kozlowski* and Gen Green, Utah Division of Wildlife Resources, Sensitive Species Program, Ogden, UT (AJK), The Nature Conservancy, Utah Field Office, Salt Lake City, UT (GG).

8:40-9:00 AM — Conservation strategies for the coastal pallid bat (*Antrozous pallidus pacificus*).
Dave S. Johnston* and Drew C. Stokes. H. T. Harvey & Associates/San Jose State Univ., San Jose, CA (DSJ); US Geological Survey, San Diego, CA (DCS).

9:00-9:20 AM — The California Bat Conservation Plan.
Elizabeth D. Pierson*, Betsy Bolster, and Bronwyn Hogan, California Biodiversity Center, University of California, Berkeley, CA (EDP), California Department of Fish and Game, Sacramento, CA (BB), California Department of Fish and Game, Stockton, CA (BH).

9:20-9:30 AM — Protecting important roost sites from renewed energy development in Colorado.
Kirk W. Navo*, Lea R. Bonewell, Nancy LaMantia-Olson, Mark A. Hayes, and John Nuessel. Colorado Division Of Wildlife, Monte Vista, CO (KWN), USGS, Fort Collins, CO (LRB), Colorado Division Of Wildlife, Denver, CO (NLO), Univ. Northern Colorado, Greeley, CO (MAH), Silverthorne, CO (JN).

9:30-9:50 AM — Break

Inventory and Monitoring of Bats

Moderator: Bill Burger, Arizona Game and Fish Department

9:50-10:10 AM — The Status of Allen's Lappet-eared Bats (*Idionycteris phyllotis*) in New Mexico.
Lyle A. Lewis*, William E. Rainey, and Chris Corben. U.S. Fish and Wildlife Service, Albuquerque, NM (LAL); University of California Berkeley, Berkeley, CA (WER); 404 Melbourne St., Columbia, MO 65201 (CC).

10:10-10:30 AM — Towards the elucidation of chemical profiles from the volatile glandular secretions of Townsend's big-eared bat.
Samuel L. Skalak*, Daniel D. Clark, and R.E. Sherwin, Christopher Newport University, Newport News, VA.

10:30-10:50 AM — Using ultrasonic calls of lesser long-nosed bats (*Leptonycteris curasoae*) for inventory and monitoring.
Ronnie Sidner* and Debbie C. Buecher, Ecological Consulting, Tucson, AZ (RS), University of Arizona, Tucson, AZ (RS, DCB).

10:50-11:10 AM — Designing a Site-Occupancy Program to Evaluate Broad-scale Habitat Associations in the Pacific Northwest.
Theodore J. Weller, USDA Forest Service, Pacific Southwest Research Station, Arcata, CA.

11:10-11:40 AM — The Bat Grid: a Standardized Approach to Surveying for Bats.
Patricia C. Ormsbee*, Aimee H. Hart, Tom Rodhouse, Jan Zinck, Lorelei Patrick US Forest Service, Eugene OR (PCO, AHH), National Park Service, Bend, OR (TR), Portland State University, Portland, OR (JZ, LP).

12:00 PM — Meet for Field Trip to Kartchner Caverns
Hilton Lobby (Return around 7:00 PM)

Presentation Abstracts

Assessing the Impacts of Wind Turbines on Bats
Edward B. Arnett, Bat Conservation International, Austin, TX.

Unexpectedly high numbers of bat fatalities reported at wind energy facilities on ridge tops in the eastern United States, and more recently in open prairies of southern Alberta, have heightened the urgency to understand problems and identify solutions. Here, I present an overview of key issues surrounding wind energy development and bat fatality, the extent of the problem, our current state of knowledge, and provide an update on current pre- and post-construction research efforts. I also discuss future research needs and policy and regulatory actions that could help protect bats in the future.

Making the most of destructive sampling: Why we Should be Banding Migratory Bats
Robert Barclay, Jeff Gruver*, Erin Baerwald, Joanna Coleman and Cori Lausen, University of Calgary, Calgary, AB.

Here, we present an argument for the benefits of a standardized, concerted effort by North American researchers to band migratory bats. Bat fatalities at wind energy facilities in North America to date overwhelmingly comprise migratory species, especially hoary bats (*Lasiurus cinereus*), red bats (*L. borealis*), and silver-haired bats (*Lasionycteris noctivagans*). Currently, efforts are ongoing to develop effective mitigation strategies for turbine-related bat fatalities, and we feel that basic knowledge of the migratory behavior and population dynamics of the species most at risk will be crucial to the success of these efforts. However, our understanding of the basic biology of migratory bats in North America is limited, as these species have not been the focus of as much ecological, behavioral and population study as have hibernating species. Thus, we propose that turbine-related fatalities of migratory bats afford a unique opportunity to generate novel and much-needed knowledge about spatial and temporal patterns of migration on a continental scale. We argue that potential gains from banding likely outweigh potential costs, and that banding hoary, red and silver-haired bats caught during scientific studies and faunal surveys should be encouraged and coordinated.

Bats and wind energy facilities in southern Alberta: a case study
Erin F. Baerwald, University of Calgary, Calgary, AB.

Southern Alberta currently has 16 wind farms with ~400 turbines and numerous other projects in various stages of development. Historically, bat fatality rates were <1 bat/turbine/year. In 2005, 532 bats (~13 bats/turbine) were found at the Summerview Wind farm, and in 2006 there was a similar pattern, with 619 bats found (~16 bats/turbine). The majority of bat fatalities were hoary bats and silver-haired bats during late summer/early fall. My research questions are: what proportion of bats migrating through a wind farms' area are being killed, how do weather variables affect bat activity and fatality, why are more bats killed at some wind farms than others, and how effective/accurate is ground-based echolocation detection in estimating the risk to bats? I am using several methods to address these questions: acoustic monitoring at 30m and ground at six sites located across 200km in southern Alberta, marine radar, and daily and weekly carcass searches at Summerview turbines. Preliminary data show that bat activity varies among sites and between heights. Bat fatality varies among turbines and nights. Timing of bat fatalities varied by both species and sex. There is evidence of migratory events and areas of greater bat activity, but so far no clear migratory pathway can be delineated.

Management Issues of Bats and Mines on a Landscape Level
Patricia E. Brown* and Robert Berry. Brown-Berry Biological Consulting, Bishop, CA

Most bat species use a variety of roosts throughout the annual cycle as dictated by physiological and behavioral needs. This is especially true of bats roosting in mines. Rarely does a bat colony occupy a single mine year round. Abandoned mines face threats from mine closure for hazard abatement and renewed mining. The timing of surveys will influence the ability to detect bat use of a given mine feature. This in term can affect the treatment that a mine may receive (sealing/hard closure, bat-compatible closure or no action), and the timing of bat eviction for hard closures. To understand the importance of a given mine feature, most of the mines in a given geographic unit (drainage or mountain range) may need to be evaluated in order to determine those with most significant bat use at different times of the year. The scope of the "landscape" will depend on the species of bat and their dispersal ability. If possible, foraging as well as roosting habitat needs to be considered. Several case histories will be given for *Macrotus* and *Corynorhinus* from California and Nevada.

Passive Acoustic Sampling to Differentiate Bat-use between Native Cottonwood Galleries and Non-native Saltcedar Groves in southern Arizona.
Debbie C. Buecher* and Ronnie Sidner, Wildlife and Fisheries Science, School of Natural Resources, University of Arizona, Tucson, AZ (DCB), University of Arizona, Tucson, AZ and Ecological Consulting, Tucson, AZ 85745 (RS)

The spread of invasive plant species, such as saltcedar (*Tamarisk* spp.), along riverine corridors of western United States is expected to have negative impacts on native riparian species. To evaluate how exotic vegetation might impact foraging behavior of bats, we conducted an acoustic study to measure and compare bat foraging in monotypic saltcedar groves vs. native cottonwood galleries near the confluence of the San Pedro and Gila Rivers in southern Arizona. During summer 2006, we used four Anabat II (frequency division) ultrasonic bat detectors, twice a month for four months, in a pairwise sampling design. We measured bat-use as the average number of foraging calls per hour in each habitat. We also assigned call sequences of sufficient length to one of five species guilds to further evaluate the impact of non-native vegetation on specific bat species. Our results suggest a highly significant correlation between increased bat foraging and native cottonwood galleries. The foraging response of specific bat guilds to native vs. non-native vegetation was variable but most species preferred to forage over native vegetation. Because invasive plant species influence historic biotic community structure, it is critical that we understand how native taxa use riparian corridors in order to evaluate the impact of non-native plants and animals.

Objectives, Uncertainties and Biases in Bat Mortality Studies at Wind Facilities
Wallace Erickson and Ed Arnett*, WEST Inc. Cheyenne, WY, Bat Conservation International, Austin, TX

We review methods used in design, implementation, and analysis for post-construction mortality studies of wind facilities. We identify various objectives and goals of these studies, and review different study designs used to meet these objectives. For example, studies designed to determine whether overall mortality at a particular project is within the range of anticipated levels may require a different design and less effort than studies designed to test hypotheses regarding lighting effects, topographic effects or other environmental variables, or studies to estimate individual species mortality levels. Regardless of the objectives, key biases that should be considered include observer detection bias, scavenging bias, (both of which are influenced by

habitat and visibility that must be accounted for) and plot size bias. We review field and analysis approaches used to consider and estimate these biases. Computer simulation results are presented that investigate precision and accuracy of the estimators as a function of search interval, scavenging bias, and observer detection bias. In addition to fatality rates, we provide some simple approaches used to calculate indices of potential collision risk. Case studies throughout North America in numerous habitats are included in our review. Recommendations are made regarding how methods can be improved and where to focus our research efforts.

Effects of Landscape Structure and Prey Availability on Insectivorous Bat Foraging Ecology

Elizabeth M. Hagen* and John L. Sabo, Arizona State University, Tempe, AZ

River and riparian areas support high bat foraging activity, presumably as a result of high aquatic insect availability; however, structural features of the landscape (river channel confinement and riparian vegetation) may also influence bat foraging activity. To test the hypothesis that landscape structure indirectly affects bat foraging activity by controlling the location of insect aggregations, we measured bat activity and insect availability along the South Fork Eel River in northern California, USA. Bat foraging activity was measured using Anabat detectors at 21 sites classified as confined, unconfined with riparian vegetation, and unconfined without riparian vegetation, May – August 2006. Insect availability was measured using emergence traps and sticky traps at 9 of the above sites three times throughout the summer. Mean bat activity ranged from 278 – 1912 calls/night and was negatively related to channel confinement (linear regression, $p = 0.03$). Mean bat activity did not significantly differ between unconfined sites with riparian vegetation (287 calls/night) and those without (312 calls/night). Bat activity decreased exponentially with distance from the river tracking declines in insect abundance. These patterns suggest that channel geomorphology influences the location of bat foraging activity by limiting the extent of lateral penetration of aquatic insects into the terrestrial landscape.

Modeling Hibernacula Selection by Townsend's Big-eared Bat

Mark A. Hayes*, Rob A. Schorr, Kirk W. Navo, and Rick A. Adams. University of Northern Colorado, Greeley, CO (MAH, RAA), Colorado Natural Heritage Program, Fort Collins, CO (RAS), Colorado Division of Wildlife, Monte Vista, CO (KWN).

We analyzed 9 years of data from 148 internal mine surveys conducted in southwestern Colorado during the winter months from 1999-2007 and modeled hibernacula use by *C. townsendii*. Logistic regression and Akaike's Information Criterion were used to guide model selection. We developed two balanced model sets, one set with 15 models that included mine-site variables, and another set with 7 models that included landscape and weather variables. We calculated Akaike weights for each model and model-averaged estimates, unconditional standard errors, and 95% confidence intervals to assess the magnitude of the effect related to each variable. The results indicate that the model "number of openings + portal temperature", with an Akaike weight of 0.30 and evidence ratio of 1.88, has the most support of the mine site models. The variable "number of openings" had a relative importance value of 0.96 and a 95% confidence interval of 0.436 - 0.675, which excludes 0 and indicates that the number of openings at a mine has a positive effect on *C. townsendii* occupancy. All of the landscape and weather models and variables yield poor support. Results of this study and management recommendations will be summarized.

Low-cost, Low-power, Long-duration acoustic bat detectors
Matthew J Heavner*, Carolyn E Talus, University of Alaska Southeast, Juneau, AK

A new low-power, computer-based acoustic sensor for long-duration (~100 days) observations of bats has been developed. This presentation describes the system and the development decisions driving the final design for the system, specifically the tradeoffs between power consumption, processing power, and scientific and monitoring needs. Long duration monitoring of several different types of area (such as old-growth vs recently logged forest) will provide knowledge to improve management practices in regards to bat ecology in Southeast Alaska. The results of monitoring done to validate the system design during 2005-2006 showing atypical bat activity throughout the night will be presented to illustrate the possible applications of the bat detection system. The role of long duration acoustic monitoring and deployment strategies for Southeast Alaska will be described.

This talk is available as a powerpoint at:
http://talus-and-heavner.com/rs/conf/2007WBWG/3_HEAVNER_2007WBWG_Real_Final.ppt

A Bat Roost Survey Protocol for Caves and Mines
Michael J. Herder* and Patricia C. Ormsbee, USDI Bureau of Land Management, Arizona Strip, St. George, UT (MJH), USDA Forest Service, Willamette National Forest, Eugene, OR (PCO).

Bats spend more than half their lives roosting. Conducting surveys to identify structures used for bat roosting is fundamental to improving our ability to provide responsive management for bats and their habitat. Management actions such as permanent mine closures can result in loss of habitat and/or bat mortality. Few survey protocols are available that address the range of possible survey objectives. We discuss an example of a cave and mine survey protocol designed to meet three potential survey objectives: immediate pre-closure, determination of bat presence, and identification of one or more target species. The protocol includes a discussion of preferred methods, as well as an estimate of the number and timing of surveys required for determination with minimal certainty that bats do not roost at the site. A sample scenario is provided to illustrate how the protocol can be adapted to focus detecting use across different seasons and in different climatic conditions.

California Bat Working Group Bat and Wind Energy Guidelines.
Bronwyn Hogan, California Department of Fish and Game, Stockton, CA

(Abstract not available)

Relevant Websites:

California Bat Working Group Wind Energy Protocol available on CEC website:
http://www.energy.ca.gov/renewables/06-OII-1/documents/public_comments/CBWG_wind_energy_guidelines_09-08-06.pdf

All other documents and latest draft of the California Energy Commission/California Department of Fish and Game Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development also available at same website:
http://www.energy.ca.gov/renewables/06-OII-1/documents/index.html#comments

Research priorities and future wind energy research funding possibilities are posted as they become available at the Public Interest Energy Research (PIER) website:
http://www.energy.ca.gov/pier/environmental/

Differential Use of Pinyon-Juniper Woodland Habitat by Townsend's Big-Eared Bats (*Corynorhinus townsendii*) in Pershing County, Nevada

R. R. Ives, R. E. Sherwin*, J. Jeffers, S. L. Skalak, D. Dalton, and S. Wolf, Christopher Newport University, Newport News, VA (RRI, RES, SLK), Nevada Department of Wildlife, Fallon, NV, (JJ), Wildlife Engineering, Tucson, AZ, (DD, SW)

Over the past 150 years, pinyon-juniper woodlands have been dramatically impacted by harvesting, warming climate, heavy livestock grazing, and decreased fire frequency. Considered unproductive by some range managers, piñon-juniper woodlands have been controlled by prescribed fires and mechanical removal. Although conversion of western woodlands to shrub-steppe plant communities may increase avian and nonvolant mammal diversity, recent research has shown that several bat species may be reliant on pinyon-juniper woodlands for foraging and roosting habitat. As part of this research, we investigated use of pinyon-juniper woodlands by Townsend's big-eared bats. We used radiotelemetry to follow bats from roosts to foraging areas in Pershing County, Nevada. Bats foraged in pinyon-juniper woodlands along with sagebrush-steppe, salt-scrub, and desert grasslands. While at larger spatial scales we observed variations in habitat associations, we found strong affinities among individual colonies and specific habitat types. For example, we recorded individuals traveling to foraging areas in pinyon-juniper woodlands located in excess of 15 kilometers from day roosts. In this talk, we will discuss habitat and foraging associations, nightly patterns of activity, availability and habitat differences of prey items, and implications for the management of Townsend's big-eared bats in Nevada.

Conservation strategies for the coastal pallid bat (*Antrozous pallidus pacificus*)

Dave S. Johnston* and Drew C. Stokes, H. T. Harvey & Associates/San Jose State University., San Jose, CA (DSJ); US Geological Survey, San Diego, CA (DCS).

The pallid bat (*Antrozous pallidus*) is a special-status species in California and other states, but evidence suggests that populations continue to decline regionally. In San Diego Co., pallid bats were detected in 16 out of 23 locations earlier identified in 1948. In Santa Clara Co. in the South Bay Area, 5 out of 10 roosts have been extirpated since the 1950s. Significant amounts of foraging habitat have been converted to suburban development in home ranges for 6 of 10 maternity colonies in the South Bay Area, and most colonies are at risk. In other regions, threats include eradication, mine closures, timber harvests, habitat conversion, pesticide spraying, and bridge replacement/improvement. Planners, environmental consultants, and regulatory agency personnel need be more vigilant about establishing the need for bat surveys and identifying potential impacts to bats, particularly cumulative impacts to populations. A conservation strategy should include short-term and long-term mitigation for the significant loss of roosting and foraging habitats. Although most conservation efforts are difficult to implement through environmental law, but other peripheral tools (e.g., California Department of Fish and Game streambed alteration agreements and conservation easements) may also be used to promote conservation strategies.

Predictive Modeling of Important Chiropteran Habitat In Utah

Adam J. Kozlowski* and Gen Green, Utah Division of Wildlife Resources, Sensitive Species Program, Ogden, UT (AJK), The Nature Conservancy, Utah Field Office, Salt Lake City, UT (GG)

A recent exhaustive review of bat research in Utah indicates that little information is available regarding the basic ecology of Utah's bat species. Of the 18 bat species currently known to inhabit Utah, six (30%) are already listed on the state's sensitive species list and are identified as

species of conservation concern in Utah's Wildlife Action Plan. In November 2006, members of the Utah Bat Conservation Cooperative, representing 12 public agencies and private organizations, began an effort to model the landscape characteristics that promote or limit potential use by bats. Specifically, the model is designed to identify the distribution, quantity, and quality of bat habitat based on the combined suitability of six key resources: water availability, vegetation community, geology, slope, aspect, and elevation. The final model is a 30m resolution, GIS layer of statewide extent that is eminently portable and scalable, facilitating the expansion of geographic inference into neighboring states, forests, or districts. We believe Utah's important bat habitat model will provide an important base layer against which to analyze past inventory work, prioritize future monitoring efforts, quantify the effects of current land management practices and disturbances on bats, and provide Utah and all of its cooperators with a data model upon which to set priorities, collaborate on objectives, and emphasize system health.

The Trials and Tribulations of a Two-Year Marking Project with the Lesser Long-Nosed Bat (*Leptonycteris curasoae)* in Southern Arizona.

Karen Krebbs*, Tim Tibbitts, Ami Pate, and Curtis McCasland, Arizona-Sonora Desert Museum, Tucson, AZ, (KK), Organ Pipe Cactus National Monument, Ajo, AZ (TT, AP), Cabeza Prieta National Wildlife Refuge, Ajo, AZ (CM)

We tested several different markers (bands, necklaces, reflective tape, microchips, fluorescent powder) on a captive group of California leaf-nosed bats (*Macrotus californicus)* and utilized the best markers for our field project with the lesser long-nosed bat (*Leptonycteris curasoae).* During the two-year project we placed markers on 106 lesser long-nosed bats at two different maternity roosts in southwestern Arizona and attempted to follow the marked bats to other roosts and areas in southeastern Arizona. We tested microchips (PIT Tags) and developed a new antenna design for detecting the microchips at the bat roost. Developing new marking techniques on an endangered bat is difficult. Even more difficult are the dangers of working along the Arizona-Mexico border and the problems associated with roost access and timing. Despite the physical, monetary, and political restraints for this project we located three of the marked bats in southeastern Arizona. These results indicate that you can complete a project of this type despite the numerous obstacles that are encountered when working with an endangered bat in southern Arizona.

Six Years of Forest Bat Research by the Northwest Bat Cooperative

Michael J. Lacki, Michael D. Baker, and Henning C. Stabins*, University of Kentucky, Lexington, KY (MJL & MDB), Plum Creek Timber Company, Columbia Falls, MT (HCS).

The Northwest Bat Cooperative (NBC) formed in 2000 as an alliance of state and federal agencies, private industry, and non-governmental organizations interested in cooperatively funding priority monitoring and research needs for bats at a localized scale in the Pacific Northwest. The NBC has successfully secured and administered cooperative funding among interested parties and allocated these resources by implementing a 6-year research project studying bat roost site ecology. The study focused on roost-site selection in upland versus riparian areas and roost microclimates of tree-roosting bats in xeric coniferous forests of Washington, Oregon, and Idaho, among landscapes with a diversity of ownerships and forest management. Multiple manuscripts are available (or in press and in progress) ranging from power analyses, roost site characteristics, foraging behavior, to landscape modeling. Future directions of NBC efforts are discussed.

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An overview of the Alberta document: *Bats and Wind Turbines. Pre-siting and pre-construction survey protocols.*

Cori Lausen*, Erin Baerwald, Jeff Gruver, and Robert Barclay, University of Calgary, Calgary, AB.

The bat working-group in Alberta (ABAT) was approached by Sustainable Resource Development, part of the Alberta Government, to assist in the production of Wildlife Guidelines for Alberta Wind Energy Projects. We were asked to develop a pre-construction protocol for assessing potential risk to bats at sites of proposed wind turbines. Here we provide an overview of this protocol. We recommend use of acoustic monitoring during late summer/early fall for 2 years. For sites with ≤5 turbines we recommend a detector at each proposed turbine location; for sites with >5 turbines, at least one detector at the north, east, south, and west peripheries, and one in the centre. If the proposed area encompasses a diverse terrain, then using more detectors may be necessary. Because mortality occurs in the rotor-swept area, microphones should be placed ≥30 m above ground. It is not clear to what extent migrating bats echolocate. As such, radar may be useful, although at the moment, distinguishing bats from birds using radar is problematic. Meteorological data may correlate with bat abundance, and be important in mitigation strategies. Minimally, temperature, wind speed and direction, and rainfall should be collected at the same time bat activity is measured.

For more information, visit the ABAT website at:
http://www.srd.gov.ab.ca/fishwildlife/wildlifeinalberta/batsalberta/abat.aspx

Beyond mtDNA: nuclear gene flow confutes cryptic species in little brown bats (*Myotis lucifugus*)

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Although useful for elucidating past evolutionary events, mtDNA can obscure species' boundaries; its observed discordance with morphology, biology, and geography of some currently recognized species raises a red flag as to its usefulness in determining taxonomy. In southern Alberta and north-central Montana, we found substantial mtDNA sequence divergence between two groups of little brown bats, previously thought to be subspecies (*M. lucifugus lucifugus* and *M. l. carissima*), but hypothesized to be separate species based on mtDNA (Dewey 2006, PhD Dissertation, University of Michigan). However, using nuclear DNA (microsatellites), we found these two groups of bats fully interbreeding where sympatric. Additionally, we found forearm and pelage coloration differences originally used to define these as subspecies did not hold, and the two groups of bats were found in mixed maternity colonies. Our findings, together with the recent discovery that *M. l. lucifugus* haplotypes are found throughout the range previously thought to be only *M. l. carissima* (Dewey 2006), leads us to conclude that no distinct genetic, geographic or morphological boundary can be drawn between these two groups. We thus suggest the *carissima* subspecies designation be dropped. This study highlights the importance of determining contemporary gene flow in sympatrically occurring animals suspected of being cryptic species.

Long-distance Movements of Nevada Populations of the Mexican Free-tailed Bat (*Tadarida brasiliensis mexicana*)

Philip Leitner, St. Mary's College of California, Moraga, CA. ** Presented by PatBrown, Brown-Berry Biological Consultants, Bishop, CA.

The Mexican free-tailed bat (*Tadarida brasiliensis mexicana*) occurs throughout Nevada, but there are no published accounts of the seasonal status or movements of populations in this region. Cockrum (1969) hypothesized that *T. b. mexicana* present in Nevada in the summer are part of a distinct group that spends the winter in southern California or northern Baja California. I banded 5,862 *T. b. mexicana* at Osceola Cave in east-central Nevada on Aug. 10-11, 1970. Two band recoveries from Las Vegas, NV (300 km south) and one from Yuma, AZ (700 km south) were consistent with fall migration to the lower Colorado River valley. However, a banded female was recovered in northwest Kansas (1250 km east) in May 1971, which may reflect long-distance fall migration to Mexico and subsequent spring movement north through Texas and Oklahoma. At a maternity colony near Fallon in western Nevada, I banded 826 juvenile *T. b. mexicana* on Aug. 10, 1971. From Sept. 1971 through Mar. 1972, there were eight band recoveries from central California, suggesting that at least some members of this population moved over the Sierra Nevada in the fall and spent the winter up to 220 km west in California valley and foothill areas. A recovery at Lake Tahoe (1900 m elevation) on Oct. 11, 1971 suggested a possible migration route. The Aug. 1971 recovery of a bat near Reno, NV that had been banded at Fairfield in central California on Sept. 26, 1969 provided further evidence of interchange between *T. b. mexicana* populations separated by the Sierra Nevada. Although these banding results are based upon a very small number of recoveries, they indicate the potential for gene flow across the entire range of the nominal *T. b. mexicana* subspecies from California to the Great Plains. These field data suggest patterns of long-distance movements that could help to explain the results of recent genetic studies (McCracken and Gassel 1997), which have failed to find geographic or population-level structuring within *T. b. mexicana*. There may not be serious inconsistencies between the molecular genetic data and the data from traditional banding studies in this highly vagile taxon.

The Status of Allen's Lappet-eared Bats (*Idionycteris phyllotis*) in New Mexico

Lyle A. Lewis*, William E. Rainey, and Chris Corben. U.S. Fish and Wildlife Service, Albuquerque, NM (LAL); University of California Berkeley, Berkeley, CA (WER); Columbia, MO (CC).

Very little is known about the life history of the Allen's lappet-eared bat (*Idionycteris phyllotis*) in New Mexico. Limited information suggests their roosting requirements are very specialized. Between 1957 and 1975, although not abundant, Allen's lappet-eared bats were fairly consistently captured at some survey sites by bat researchers in New Mexico. Over the last 30 years, they have been captured less frequently. Netting and acoustic sampling for bats over 7 years/seasons at surface waters in forested areas of southwestern New Mexico is directed at whether the presence of the Allen's lappet-eared bat as part of bat assemblages in these habitats differ from more heavily managed/exploited forests. An analysis of historical occurrence records, limited roosting information, and comprehensive surveys since 2000 suggest that viable populations of Allen's lappet-eared bats may now be primarily limited to southwest New Mexico wilderness areas. Bat activity and trappability is heavily influenced by seasonal and interannual variation in snow pack, stream flows and amount of persistent surface water, so this should be considered an interim report. Recent acoustical survey efforts in New Mexico suggest the ability to differentiate Allen's lappet-eared bats from spotted bats (*Euderma maculatum*) is extremely limited.

Considerations for Wildlife in the Permitting of Wind Energy Facilities.
Jim Lindsay, Florida Power and Light.

The complex aspects of developing a commercial wind energy facility will be discussed with an emphasis on determining risks to wildlife in the pre-construction phase and verifying those risks with post construction monitoring. The presentation will also compare and contrast emerging trends in state guidelines and provide an update on the U.S. Fish and Wildlife Services interim guidelines.

Colorado Bats/inactive Mines Project: or "Just what have we been doing all these years"?
Kirk W. Navo*, Tom E. Ingersoll, Lea R. Bonewell, Nancy LaMantia-Olson, Antoinette J. Piaggio, and Sophie R. Oglesby. Colorado Division Of Wildlife, Monte Vista, CO (KWN), UC, Berkley, CA (TEI), USGS, Fort Collins, CO (LRB), USDA/ National Wildlife Research Center, Fort Collins, CO (AJP), Colorado Division Of Wildlife, Denver, CO (LNO/SRO)

The evaluation and preservation of abandoned mines for the conservation of bats in the Western US is an ongoing and important wildlife conservation challenge. The Colorado Bats/Inactive Mines Project has been working on this issue since 1991. The Colorado program provides an example of an approach that has evolved over time, and which reflects the decisions that are typically undertaken in the planning and implementation of such resource management projects. Resource managers are faced with the task of developing effective wildlife conservation actions in a time and funding limited environment. An overview of the development and evolution of the Colorado project is provided, and accomplishments are outlined so that participants can evaluate the pros and cons of this conservation effort and approach. The Colorado Bats/Inactive Mines Project is currently in its 17th year of operation, and has undergone numerous alterations to the evaluation processes as a result of changing science and management variables. The methodology, funding strategies, and priorities have evolved over time to foster strong partnerships, tangible results, and issue support. However, management factors have also resulted in the reality of missed conservation opportunities and enhancement of the science involved with the issue.

Protecting important roost sites from renewed energy development in Colorado
Kirk W. Navo*, Lea R. Bonewell, Nancy LaMantia-Olson, Mark A. Hayes, and John Nuessel, Colorado Division Of Wildlife, Monte Vista, CO (KWN), USGS, Fort Collins, CO (LRB), Colorado Division Of Wildlife, Denver, CO (LNO), Univ. Northern Colorado, Greeley, CO (MAH), Silverthorne, CO (JN).

The increased activity associated with the recent push for energy development in the West has created many wildlife issues. One such issue is the recent surge in uranium prices, which has spurred a tremendous increase in the filing of mining claims at old uranium mines in Colorado. Efforts over the past 16 years by the Colorado Division of Wildlife and the BLM have resulted in the discovery and protection of roost sites for Townsend's big-eared bats (*Corynorhinus townsendii*), many of which are in the current area of interest for renewed mining. As a result, three maternity roosts for this species were under the threat of loss by potential reclaiming of the mines for active mining. Current laws and regulations regarding mineral extractions limit any conservation options to protect these sites. In Colorado, a unique approach was undertaken to provide short term protection of these roost sites while a long term option was initiated.

The Bat Grid: a Standardized Approach to Surveying for Bats
Patricia C. Ormsbee*, Aimee H. Hart, Tom Rodhouse, Jan Zinck, Lorelei Patrick US Forest Service, Eugene OR (PCO,AHH), National Park Service, Bend, OR (TR), Portland State University, Portland, OR (JZ, LP).

Research and management challenges associated with bat conservation, such as conducting inventories and monitoring strategies across the range of a species, may benefit from a standardized sampling frame and protocol. Since 2002, such a sampling frame and protocol have been implemented in the Northwestern U.S using a grid-based design. The sampling fame for this approach, known as "The Bat Grid", also is available for North America in a GIS format. We present morphological, acoustic, and genetic summary data collected using this grid approach. We will provide an overview of The Bat Grid and present some of the benefits of implementing a large-scale standardized grid by highlighting our results to-date.

Cave myotis bat *(Myotis velifer incautus)* roost monitoring and protection on Fort Hood, Texas during 2005-2006.
Charles E. Pekins, PWE Natural Resources Management Branch, Fort Hood, TX.

Fort Hood military reservation in central Texas has five known cave myotis bat (*Myotis velifer incautus*) caves: one is unstudied, three are abandoned, and one is an active maternity roost. At the maternity site, I counted emerging bats monthly using night-vision equipment. I estimated a maximum of 16,500 bats (2005) and 10,500 bats (2006) occupied the cave. To maximize emergence flow, we replaced two inadequate gates with two cupola bat gates. At the large, primary cupola volume increased 1200%, surface area increased 880%, and angle iron spacing increased to 5.75 inches. At the small, secondary cupola volume increased 920%, surface area increased 1050%, and angle iron spacing increased to 5.75 inches. Roost ceiling microclimate (temperature, absolute humidity) ranged from 11.6° C, 10.4 g/m^3 to 26.5° C, 24.9 g/m^3. To encourage velifer recolonization and provide an uncluttered flight zone, we cleared woody vegetation from a 7.6 m radius around the entrance of two abandoned caves. At these caves microclimate ranged from 13.9° C, 12.1 g/m^3 to 17.4° C, 14.9 g/m^3 (Egypt cave) and from 18.7° C, 16.0 g/m^3 to 19.9° C, 17.1 g/m^3 (Tippit cave). Abandoned cave site reactivation will provide back-up roosts for velifers should disaster befall the maternity site.

A link to the 2006 project report can be found on the Western Bat Working Group website: http://wbwg.org/conservation/papers/papers.html

The California Bat Conservation Plan
Elizabeth D. Pierson*, Betsy Bolster, and Bronwyn Hogan, California Biodiversity Center, University of California, Berkeley, CA (EDP), California Department of Fish and Game, Sacramento, CA (BB), California Department of Fish and Game, Stockton, CA (BH)

The California Department of Fish and Game recently secured funding through the State Wildlife Grant program with the U.S. Fish and Wildlife Service to develop a conservation plan for the bats of California. CDFG has contracted with UC Berkeley to lead a collaborative effort among California Bat Working Group members, CDFG and other state and federal agencies to develop a California Bat Conservation Plan. This team effort will take a three-pronged approach -- evaluating conservation needs by species, by ecoregion and by conservation issue – using a consensus ranking system similar to that used by the Western Bat Working Group in developing its Species Priority and Survey matrices. The identified conservation issues range from those, such as recreational caving and closure or elimination of abandoned mines for which the bat research community has well-developed strategies, to those, such as timber-harvest, wind farms

and hydro-projects, for which conservation strategies are being actively explored. We will also be working closely with GIS staff at CDFG to update distribution maps, based on capture and acoustic records gathered by the California bat research community. The California Bat Conservation Plan joins other statewide efforts in the west, and is included in California's new statewide Wildlife Action Plan (http://www.dfg.ca.gov/habitats/wdp/report.html) as an important conservation action.

What can genetics contribute to definitions of subspecies and migratory groups of Brazilian free-tailed bats (*Tadarida brasiliensis*)?

Amy L. Russell, Arizona Research Laboratories, Tucson, AZ

DNA barcoding has been proposed as a method of both assigning unknown individuals to species and discovering new species. The contribution of molecular genetic data to these applications can be considerable, particularly in cases where the organisms in question are understudied or morphologically cryptic, and the standardization of those molecular data across taxonomic groups is a positive goal of DNA barcoding. However, DNA barcoding has been criticized in the literature for being overly reliant on a single genetic locus and for disregarding other taxonomically relevant data such as morphology and behavior. Less appreciated pitfalls of DNA barcoding include the very real potential for Type I or Type II error when applied to taxonomic units that are geographically structured or very large, respectively. I will review these population genetic shortcomings of DNA barcoding, with an example from the Brazilian free-tailed bat (*Tadarida brasiliensis*). I will also show how recent improvements in analytical techniques in combination with testable genetic hypotheses can be used to provide a whole-organism model of speciation without disregarding decades of behavioral and morphological data.

Roost-site selection and potential prey sources after wildland fire for two insectivorous bat species (*Myotis evotis* and *Myotis lucifugus*) in mid-elevation forests of western Montana

Nathan A. Schwab and Kristi L. DuBois*, University of Montana, Missoula MT (NAS), Montana Fish, Wildlife and Parks, Missoula, MT (KLD).

Wildland fire in mid-elevation forests commonly results in mixed-severity and stand replacement burns leaving behind many standing dead trees. Numerous wildlife species use these trees including bats. Little brown and long-eared myotis were tracked via radio-telemetry to specific roost sites within two fires from the 2003 fire season in western Montana. Two logistic regression models, a biological and a management model, were constructed from variables collected at multiple scales. The biological model included all variables collected and the management model included only variables easily manipulated by land managers. The biological model contained the number of trees greater than 31-cm diameter at breast height and the number of linear stream meters within a 500-meter radius around the roost tree. The management model predicted an increase in the odds of use for trees larger in diameter, in plots of higher tree densities, and closer to water than randomly available plots. We suggest retaining large-diameter trees, in stands of higher densities and closer to water to minimize the negative effects of post-fire management practices on little brown and long-eared myotis. Insect sampling suggested burned forest provides highly productive insect habitat, which may attract insectivorous predators like bats.

Nathan Schwab's thesis can be found by going to the Montana FWP Library at the following link, then entering "Schwab" into the Author field and "Bat" into the title field: http://fwp.mt.gov/insidefwp/fwplibrary/wildlifelib/referencelistwild.asp

Whistling in the dark: determining significance of individual abandoned mines within a landscape of complexity

Richard E. Sherwin, Christopher Newport University, Newport News, VA

While it is generally understood that organisms have clear associations with specific habitat features, the degree of expression of these associations varies across spatial and temporal scales. The potential for spatio-temporal scale dependency makes it extremely difficult to assign biological significance to site occupancy or biological phenomenon collected at small spatial scales or over short temporal periods. While patterns of landscape level use in bats have slowly become apparent, it is only recently that we have begun to understand how local patterns reflect emergent properties of entire systems. While abandoned mines provide tremendous ecological gravity within landscapes, individual bats and colonies flow among groups and features in dynamic, yet stable patterns. These findings suggest that the relationship between bats and abandoned mines is much more plastic than has been previously supposed and that current assumptions regarding habitat and roosting associations are not entirely accurate. In particular, assumptions of system stability expressed by high roost fidelity and local scales of activity are far too simplistic. Appropriate management models for abandoned mine reclamation must include a framework that facilitates the identification and protection of critical roosting habitat of bats. It is within this framework of uncertainty then that land managers must make critical decisions regarding the permanent elimination of non-renewable subterranean features from landscapes. Superficially the complex relationship between bats and abandoned mines makes the task of parsing critical from non-critical roosting habitat seemingly impossible. I suggest however, that complexity simply dictates the appropriate scale of management at which we must function. Management of organisms, such as bats, that function at landscape scales must be managed at landscape scales. Simply put, context is everything, and managers must be prepared to consider ecological integrity of roosting landscapes rather than simply the site in question. In this talk I will discuss abiotic factors of the mines themselves including issues of scale and ecological gravity along with the biotic aspects of the bats and emergent properties of this often complex relationship. These discussions will serve as a template from which I will elucidate strategies for the practical and applied management of abandoned mines.

Marking Bats Potentially Causes Injury and Disturbance: Is Marking Bats Worthwhile?

Ronnie Sidner, Ecological Consulting, and University of Arizona, Tucson, AZ

Certain biological questions about bats can only be answered if those bats are marked. Selection of appropriate marking methods depends upon the species and purpose of marking. Whichever technique is used to mark bats, it can ultimately cause injury, decreased performance, and disturbance to bats at roosts. Because of these drawbacks, serious consideration must be given to potential information benefits versus costs to bats by marking them for study. I present results of work I have conducted marking bats by wing banding. These results include life history characteristics, such as survivorship, fecundity, maternal-infant interactions, and roost fidelity for several thousand *Antrozous pallidus* and *Eptesicus fuscus*, for which results were possible because of the certainty of repeated recaptures of marked individuals. Results of conservation efforts at Kartchner Caverns for *Myotis velifer* and at Fort Huachuca for endangered *Leptonycteris curasoae* confirmed species use of particular roost sites when marked bats were observed from non-disturbing vantage points at roosts after bats had been caught and marked away from these roosts. Visual identification of bats marked at one locality and found at other localities was achieved for *L. curasoae* and *Choeronycteris mexicana*. Species longevity records were obtained from marked *L. curasoae* and *A. pallidus*. In addition, the discovery of a bat band from a marked *E. fuscus* in the regurgitation pellet of a spotted owl contributed to the known

prey list for the bird, the predator list for the bat, and the otherwise unknown location of the bats during winter after leaving their summer maternity roost. Band injury calculations are presented for *Antrozous* and *Eptesicus*.

Using ultrasonic calls of lesser long-nosed bats (*Leptonycteris curasoae*) for inventory and monitoring

Ronnie Sidner* and Debbie C. Buecher, Ecological Consulting, Tucson, AZ (RS), University of Arizona, Tucson, AZ (RS, DCB)

For bat species that can be identified by their ultrasonic calls, inventory methods using sonar greatly increase the capability to locate bats in far wider landscapes or inaccessible situations than has been accomplished by traditional netting or search techniques. More importantly, making use of ultrasonic calls for identification and inventory allows less disturbance of bats than traditional methods. We recorded sonar in situations where *Leptonycteris curasoae* was previously known to occur in both roosts and foraging territory. Then we analyzed recorded calls using call characteristics that we had identified for this endangered species from both frequency division (Anabat II) and time expansion (Pettersson D240x) sonar detectors and showed that the species was, in fact, present. Furthermore, besides species presence, the sonar record showed information about activity patterns and areas of cave use by lesser long-nosed bats without disturbing the species. In addition, we identified the species in new foraging territory where it had not previously been documented and where mist nets would probably not have been successful. Recording the distinctive ultrasonic calls of *L. curasoae* is another tool to be used in the management of this species.

Surface and Spatial Roosting Patterns of Townsend's Big Eared Bats (*Corynorhinus townsendii*) in Nevada.

Samuel L. Skalak* and Richard E. Sherwin, Christopher Newport University, Newport News, VA.

Townsend's big-eared bats (*Corynorhinus townsendii*) are thought to be obligates of subterranean habitat. We tested this assumption during the summer of 2006 in Pershing County, Nevada using radio telemetry. We found these bats to disperse daily to a number of epigeic surface roosts located throughout the landscape. Additionally we collected a suite of data to quantify individual roost structures and conditions. Further, spatial patterns of bats among roosts were recorded and may provide further insight into roosting associations. Epigeic roost structures varied dramatically and comprised a wide range of microhabitats currently not associated with this species. In this presentation we will discuss how these findings could redefine our understandings of the current spatial and temporal distribution of these animals within their landscape, and how this data advances new questions for the conservation of this species.

Towards the elucidation of chemical profiles from the volatile glandular secretions of Townsend's big-eared bat

Samuel L. Skalak*, Daniel D. Clark, and R.E. Sherwin, Christopher Newport University, Newport News, VA.

We sampled secretions from the glands of 54 Townsend's big-eared bats (*Corynorhinus townsendii*) in Pershing County, Nevada during the summer of 2006. These secretions were analyzed by GC/MS (gas chromatography/ mass spectrometry) for the separation of each component in the glandular secretions with concomitant mass spectral analysis. To date, the analysis of these chromatograms suggests that GC/MS may provide a useful tool for the

identification of the chemical profile of the glandular secretions from Townsend's big-eared bats. Comparisons of the chromatograms generated from the analysis of the secretions from other bat species, such as *Antrozous pallidus*, to the Townsend's chromatograms reveal striking differences in the chemical profiles between the species. Furthermore, we are investigating the utility of this method to identify the current or historic use of specific habitats by Townsend's bats. Townsend's bats produce secretions that provide distinctive staining on surfaces where they form maternity colonies and we hypothesize that GC/MS may be a powerful and rapid method for the evaluation of these critical habitats for management purposes.

Roosts of Allen's lappet-browed bat (*Idionycteris phyllotis*) in northern Arizona.
Solvesky, B.G.* and C.L. Chambers, School of Forestry, Northern Arizona University, Flagstaff, AZ 86001-5018 USA.

We examined roosting habits of Allen's lappet-browed bat (*Idionycteris phyllotis*) in ponderosa pine (*Pinus ponderosa*) forests in northern Arizona during summer 2006. We used radio telemetry to locate new roosts (n = 9) and resurveyed maternity roosts (n = 11) located in 1993-95. Maternity roosts (n = 20) were located in larger than average diameter at breast height (dbh) ponderosa pine snags, under exfoliating bark and near a linear edge. The forest immediately surrounding maternity snag roosts had higher densities of snags, large diameter trees and downed woody debris than did forest surrounding randomly-selected snags. Exit counts conducted for maternity snag roosts located in 2006 averaged 12 ± 2 bats per roost and were located an average distance of 1.9 ± 0.3 km from capture sites. We also located 2 male roosts (males captured in same areas as females) in vertical sandstone canyon cliff faces in lower elevation pinyon-juniper (*Pinus edulis-Juniperus* spp.) woodlands ~12 km from capture sites, indicating sexual segregation may occur during the maternity season. We resurveyed maternity snag roosts located in 1993-95, 1 continued to function as a roost; however, all other snags had fallen or no longer had exfoliating bark capable of supporting a maternity colony.

Efficiency and use of external survey techniques when monitoring for Townsend's big-eared bats (*Corynorhinus townsendii*) in Pershing County, Nevada
Jonathan H. Warren*, Richard E. Sherwin, Christopher Ross, and Jason Williams, Christopher Newport University, Newport News, VA (JHW, RES), Bureau of Land Management, Reno, NV (CR), Nevada Department of Wildlife, Ely, NV (JW).

During the summer of 2006, 38 mine openings were surveyed for use by bats using a variety of external survey methods, with a total of over 3800 hours of data collected. These included a wide range of tools such as TrailMasters, Sony Nightshot cameras with supplement LED's, night vision binoculars, a closed-circuit camera system, a remote controlled vehicle, and flood lights. One aspect of this project involved the direct comparison of data collected by Sony Nightshot cameras, night vision binoculars, and TrailMasters. Another aspect of this study was to determine the amount of time required to collect data in order to get accurate picture of bat activity at a mine opening. We found that night vision and IR cameras produced consistent and reliable results, however, without exception, the TrailMaster grossly under estimated bat activity making it an unreliable tool for diagnosing bat activity at abandoned mines. Based upon the data analyzed to date there is evidence that one must collect data all night at a mine opening in order to get an accurate picture of bat activity.

Designing a Site-Occupancy Program to Evaluate Broad-scale Habitat Associations in the Pacific Northwest

Theodore J. Weller, USDA Forest Service, Pacific Southwest Research Station, Arcata, CA.

Bats have been associated with old-growth forest conditions on the basis of their roost preferences. However, roost habitat represents but one of their ecological needs and it is unclear whether association with old-growth forests is maintained at larger spatial scales. A key provision of the Northwest Forest Plan, which guides management of forests in the northwest United States, is to provide for the persistence of wildlife populations, especially those associated with mature and old-growth forests. Assessing the population status of forest bats, especially at large spatial scales, is difficult. During 2003 – 2004, I investigated the use of site occupancy patterns as a means of assessing species status at the bio-regional scale, in particular with respect to mature and old-growth forest conditions. 4 surveys, which employed a combination of capture and acoustic detection methods, were conducted at each of 51 sample units in northwestern California, western Oregon, and northwestern Washington. I calculated probabilities of site occupancy and detection for 8 species of bats and used sample unit occupancy estimates as a metric for evaluating habitat association. Probabilities of detection ranged from 0.25 for *Myotis evotis* to 0.53 for *M. californicus* and precision of occupancy estimates increased with probability of detection. My results suggest that occupancy estimation is an effective means for assessing regional-scale habitat associations, but may require intensive effort for species that are difficult to detect.

Non-Invasive Species Identification from Mixed-Species Samples Using Microarray Technology: An Overview of the Technology and its Practical Application

Jan M Zinck*, Maarten Vonhof, Lorelei Patrick, Portland State University, Portland, OR (JMZ, LP), Western Michigan University, Kalamazoo, MI (MV).

Recently there has been a shift in the scope of many field surveys associated with species identification, conservation, and habitat management of bats to encompass large spatial scales and intensive sampling across the range of a species. With the dramatic increase in sample size associated with these studies, less- or non-invasive techniques for assessing species presence are becoming more desirable, creating a need for more efficient and cost-effective techniques to achieve research and management goals. The use of genetic markers provides an additional source of useful characters to aid in species discrimination. DNA microarrays allow for the simultaneous analysis of thousands of DNA probes representing numerous species in a single experiment, making them ideally suited for use with non-invasively collected samples, such as hair and feces. This technology will be a key development for all management, compliance, and research efforts associated with listed (endangered, threatened, or vulnerable) bat species at the federal and state levels. Additionally, microarray technology represents a substantial cost savings, and potentially a much broader ability to test quantities of guano from natural and artificial roosts, as compared to individual pellet testing when species presence or absence from a given roosts is of interest.

Poster Abstracts

The Bat Management Program of the Barry M. Goldwater Range – West
Traci Allen, Range Management Department, Marine Corps Air Station, Yuma, AZ.

Bats have been documented throughout the mountain ranges on the Barry M. Goldwater Range (BMGR) West (Piest unpub. data 1998-2007, Dames and Moore 1996, Dalton and Dalton 1994) which is managed by the Marine Corps Air Station (MCAS) Yuma. Bats perform an essential role in the Sonoran Desert Ecosystem functioning as pollinators and providing natural pest control. Abandoned mines and steep rocky cliffs of BMGR West create bat roosting habitat with low lighting conditions, controlled humidity and temperature, and limited human disturbance. Desert washes are in close proximity to these roosts providing foraging habitat for bats. MCAS Yuma has developed a Bat Management Program for BMGR West with the overall goal of determining bat utilization of the range, locations of bat populations, and dynamics of those populations. These data will allow MCAS Yuma to effectively address future military requirements and anticipated non-military actions with sound resource management recommendations to minimize impacts to important bat species, colonies and roosts. The introduction of the plan highlights objectives and approaches to meet those objectives.

A Habitat Model for the Spotted Bat in Arizona
Carol L. Chambers*, John Prather, Michael J. Herder, and David G. Mikesic, Northern Arizona University, Flagstaff, AZ, (CLC, JP), Bureau of Land Management Arizona Strip Field Office, St. George, UT (MJH), Navajo Nation Department of Fish and Wildlife, Window Rock, AZ (DGM).

We used empirical evidence and expert opinion to develop a habitat model for the spotted bat (*Euderma maculatum*) in Arizona. The spotted bat roosts in high cliffs, close to perennial water, and forages over diverse vegetation types. We used landform (terrain) and landcover (vegetation type) layers from the Southwest Regional GAP Analysis Program to model roost (cool- and warm-aspect scarps, cliffs, and canyons) and foraging habitat (unlikely to be used, high- and low-elevation primary and secondary foraging habitat). We used a hydrology layer from the Arizona Land Resource Information System to identify perennial waters. The final distribution and habitat layer had 5 classes; 0) areas outside the likely range of the spotted bat, 1) areas within the range of the spotted bat but unlikely to be used, 2) areas of primary high-elevation foraging habitat, 3) areas of low-elevation foraging habitat, and 4) potential roosting areas within the predicted distribution of the spotted bat. Based on our model, we predicted that Arizona Game and Fish Department Region 2 (northern Arizona) would have the highest area of primary high elevation foraging habitat, roosting habitat, and secondary foraging habitat.

Roswell, New Mexico Hibernating Bat Count
Jennifer Foote, volunteer for Bureau of Land Management Roswell NM.

Information on size and stability of the bat population is important in cave and wildlife management. Over the last 10 years, volunteer cavers have conducted annual hibernating bat counts in 9 caves designated as hibernacula within the Roswell NM BLM district. Historical data has been collected as far back as the late 70's. Bat species inventoried include *Myotis velifer*, *Myotis ciliolabrum*, and *Corynorhinus townsendii*. One cave hibernaculum has had variations between 300 and 14000 bats counted. Information to be presented in this poster will include historical data and techniques used to inventory the bat hibernaculums.

Radionuclides in Bats Using a Contaminated Pond on the Nevada Test Site, USA.
Derek B. Hall*, Ronald W. Warren, Paul D. Greger, National Security Technologies, Las Vegas, NV.

In arid environments, water sources are sparsely distributed across the landscape and are critical resources necessary for the survival of bats that concentrate around these water sources to drink and forage. Contaminants in water supplies have the potential to adversely affect animals using them. Sampling was conducted at a pond which collects and holds water that percolates through fractures in a tunnel system constructed to test nuclear weapons on the U.S. Department of Energy's (DOE's) Nevada Test Site. Water and sediment samples, 29 bats (7 species), and 10.3 grams (wet weight) of flying insects (7 Orders) were collected from the pond. An additional 8 bats were collected from a control site. Man-made radionuclides in the contaminated pond water and sediment were tritium (^{3}H), ^{90}Sr, ^{137}Cs, ^{238}Pu, $^{239+240}$Pu, and ^{241}Am. Tritium, ^{137}Cs, $^{239+240}$Pu, and ^{241}Am were detected in bats and flying insects from the radioactive pond with little difference between bats or flying insects. Internal dose rates to bats from man-made radionuclides ranged from 6.7 x 10^{-}7 Rad/day to 2.3 x 10^{-}5 Rad/day (mean 9.0 x 10^{-}6 rad/day; median 7.0 x 10^{-}6 rad/day) and were predominantly from tritium. These levels are less than 1% of the DOE recommended dose limit of 0.1 Rad/day for the protection of terrestrial biota.

Use of Water Resources by Lactating Fringed Myotis (*Myotis thysanodes*)
Mark A. Hayes* and Rick A. Adams, University of Northern Colorado, Greeley, CO.

The fringed myotis (*Myotis thysanodes*) is a bat species of conservation concern in western North America that may be significantly impacted if water resources are depleted. To assess the importance of free-water to this species, we tracked for the first time water hole visitation frequencies of individual females of a *M. thysanodes* maternity colony using a submerged PIT-tag reader designed to track fish. We created an artificial water hole near a maternity roost in Boulder County, Colorado, and covered other naturally occurring water holes in the area. Of 24 adult PIT-tagged females, 15 individuals (10 lactating, 5 non-lactating) were repeatedly detected between 18 July and 28 August, 2006. Lactating females made a significantly greater number of drinking passes (n=255) when compared to non-lactating females (n=22). On average, lactating females visited the water hole 21.4 times per nights, while non-lactating females visited 2.4 times per night. Lactating *M. thysanodes* exhibited strong bimodal drinking patterns, with most water hole passes occurring immediately after sunset and at dawn. These data indicate that water is a key limiting resource for lactating *M. thysanodes* and suggest that the availability of water may have a strong influence on location and persistence of maternity colonies.

Bats of the Canadian North: A survey of Nahanni National Park Reserve, Northwest Territories and surrounding areas
Cori L. Lausen, University of Calgary, Calgary, AB

Little is known about bats above the 60th parallel in North America. I conducted a bat survey in SW Northwest Territories, Canada, in summer 2006, focusing on Nahanni National Park Reserve (NNPR). Previous to this survey, 2 species of bats were known from the NNPR: *Myotis septentrionalis* and *M. lucifugus*. This survey confirmed the presence of these 2 species and added the following 5 bat species: *M. evotis*, *M. volans*, *Eptesicus fuscus*, *Lasiurus cinerus* and *Lasiurus borealis*. Four species were captured in mistnets (*M. septentrionalis*, *M. lucifugus*, *M. evotis* and *M. volans*), one species was detected acoustically with several visual identifications of bats in flight (*E. fuscus*), and 2 species were detected acoustically only (*L. cinereus*, *L. borealis*). An "orange bat" near one of the *L. borealis* locations was reported after the survey. Both sexes of bats were captured, but the only species found to be raising young in the park was *M.*

lucifugus. This is the most northerly record of *M. evotis* and *M. volans* in North America. With 7 species of bats now known in the NWT, this territory has the greatest bat diversity in the North, followed by Alaska with 5-6 species.

"**Water for Wildlife": Improving access and reducing mortality for bats and other wildlife at livestock water developments**

Daniel Taylor* and Stuart R. Tuttle. Bat Conservation International, Austin, TX, (DT) and USDA-Natural Resources Conservation Service, Flagstaff, AZ (SRT).

Livestock water developments are often one of the few water sources available to wildlife on western rangelands. Bats are especially vulnerable to water shortages, sometimes losing up to 50% of their body weight in evaporative water loss daily. Without proper wildlife escape structures and maintenance, significant mortality to bats and other wildlife can occur at livestock troughs. Evidence suggests thousands of birds and mammals are drowned annually, including protected species. We evaluated 367 troughs from several western states and conducted experiments on the effects of water development configuration and water level on bat access. Wildlife escape structures were present in < 8 percent of the troughs we inspected and >50 percent had obstructions such as fencing or bracing that would inhibit access to bats and birds that drink on the wing. Bats required 3-6 times the number of approaches to successfully drink from troughs with obstructions. The ratio of successful to unsuccessful drinking attempts by bats changed from approximately 2:1 to 1:2 when water levels were lowered by 12"or greater in 6-14 foot troughs. Wildlife escape structures can be built and installed inexpensively and alternative fencing and bracing methods can facilitate bat access while still meeting livestock management objectives.

"Water for Wildlife" can be viewed and/or downloaded from the Bat Conservation International website at: http://www.batcon.org/home/index.asp?idPage=62&idSubPage=56

Myotis velifer using a properly-designed escape ramp (Dan Taylor).

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