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# DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Saturday 8:00</th>
<th>Board of Directors’ Continental Breakfast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturday 9-5</td>
<td>Board of Directors’ Meeting</td>
</tr>
<tr>
<td>Saturday 11-11</td>
<td>Registration—Performing Arts Center and Dormitory Check-In—Caldwell Hall</td>
</tr>
<tr>
<td>Saturday 6-11</td>
<td>Opening Social—Performing Arts Center</td>
</tr>
<tr>
<td>Sunday 8:40</td>
<td>Welcome—Performing Arts Center</td>
</tr>
<tr>
<td></td>
<td>Kevin D. Kephart, Vice President for Research and Dean of the Graduate School, South Dakota State University</td>
</tr>
<tr>
<td>Sunday 9:00</td>
<td><strong>Anna M. Jackson Award</strong></td>
</tr>
<tr>
<td></td>
<td>1. KINSHIP MEDIATION OF SOUTHERN FLYING SQUIRREL WINTER AGGREGATIONS</td>
</tr>
<tr>
<td></td>
<td>Katherine K. Thorington, Wake Forest University</td>
</tr>
<tr>
<td>Sunday 9:15</td>
<td><strong>Elmer C. Birney Award</strong></td>
</tr>
<tr>
<td></td>
<td>2. WHENCE AND WHEN? TESTING DIVERGENCE HYPOTHESES WITHIN PIKAS (GENUS <em>OCHOTONA</em>) USING RELAXED MOLECULAR CLOCKS</td>
</tr>
<tr>
<td></td>
<td>Hayley C. Lanier, University of Alaska Museum, University of Alaska Fairbanks</td>
</tr>
<tr>
<td>Sunday 9:30</td>
<td><strong>A. Brazier Howell</strong></td>
</tr>
<tr>
<td></td>
<td>3. ANTIPHONAL EXCHANGES ALLOW INDIVIDUAL DISCRIMINATION IN WHITE-WINGED VAMPIRE BATS (<em>DIAEMUS YOUNGI</em>)</td>
</tr>
<tr>
<td></td>
<td>Gerald Gunnawa Carter, Biology Department, B&amp;G Sciences, University of Western Ontario</td>
</tr>
<tr>
<td>Sunday 9:45</td>
<td><strong>Alma and Albert Shadle Award</strong></td>
</tr>
<tr>
<td></td>
<td>4. PHYLOGENETICS AND BIOGEOGRAPHY OF THE BROAD-NOSED BATS, GENUS <em>PLATYRRHINUS</em> (CHIROPTERA: PHYLLOSTOMIDAE)</td>
</tr>
<tr>
<td></td>
<td>Paúl M. Velazco, Department of Biological Sciences, University of Illinois at Chicago</td>
</tr>
<tr>
<td>Time</td>
<td>Event</td>
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<tr>
<td>Sunday 10:00</td>
<td>ASM Fellowship</td>
</tr>
<tr>
<td></td>
<td>5. THERMAL BENEFITS OF CLUSTERING DURING HIBERNATION: A FIELD TEST OF COMPETING HYPOTHESES ON <em>MYOTIS SODALIS</em></td>
</tr>
<tr>
<td>Sunday 10:15</td>
<td>Refreshment Break—Performing Arts Center</td>
</tr>
<tr>
<td>Sunday 10:45</td>
<td>Grinnell Award</td>
</tr>
<tr>
<td></td>
<td>6. THE NATURAL HISTORY CONUNDRUM REVISITED: MAMMALOGY BEGINS AT HOME</td>
</tr>
<tr>
<td>Sunday 11:30</td>
<td>YOUR JOURNAL</td>
</tr>
<tr>
<td>Sunday 11:45</td>
<td>8. MAMMALIAN SPECIES: MONOGRAPHS WITH IMPACT</td>
</tr>
<tr>
<td>Sunday 12:00</td>
<td>Lunch</td>
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<td>Time</td>
<td>Session</td>
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</tbody>
</table>
| Sunday 2:45 | 14. MOLECULAR SYSTEMATICS AND BIOGEOGRAPHY OF MESOAMERICAN FLYING SQUIRRELS  
Nick Kerhoulas and Brian Arbogast | 21. COMPARING CURRENT TO HISTORIC SOUTHERN DISTRIBUTION OF *OCHRO TOMYS NUTTALLI* IN FLORIDA.  
Felipe Pimentel Lopes de Melo, Bernal Rodriguez-Herrera, Robin, L. Chazdon, Gerardo Ceballos, and Rodrigo A. Medellin |
| Sunday 3:00 | 15. MOLECULAR CHARACTERIZATION OF CLASS II MHC LOCI IN THE BANNER-TAILED KANGAROO RAT (*DIPODOMYS SPECTABILIS*)  
Jorge Salazar-Bravo and Luis A. Ruedas | 29. ROOST-SITE SELECTION OF EVENING BATS (*NYCTICEIUS HUMERALIS*) AT THE NORTHERN PERIPHERY OF THEIR RANGE  
Olivia M. Münzer and Allen Kurta |
| Sunday 3:15-5:00 | Poster Session 1—Performing Arts Center | | |
| 30. MULTIPLE CAPTURES OF WHITE-FOOTED MICE (*PEROMYSCUS LEUCOPUS*)  
George A. Feldhamer, Eric M. Schauber, Leslie B. Rodman, and Timothy C. Carter | | |
| 31. SMALL MAMMALS FROM THE CHELEMHA CLOUD FOREST RESERVE, ALTA VERAPAZ, GUATEMALA  
John O. Matson, Walter Bulmer, Ralph P. Eckerlin, Nicte Ordonez, Neal Moodma, and John Hanson | | |
| 32. DISTRIBUTION OF EASTERN FOX SQUIRREL (*SCIURUS NIGER*) LEAF NESTS WITHIN A SUBURBAN/URBAN LANDSCAPE  
Carmen M. Salsbury | | |
| 33. BODY SIZE FREQUENCY DISTRIBUTIONS IN AFRICAN MAMMALS ARE BIMODAL AT ALL SPATIAL SCALES  
Douglas A. Kelt and Marc D. Mayer | | |
## Detailed Program

<table>
<thead>
<tr>
<th></th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>34.</td>
<td>TICK BURDENS OF <em>PEROMYSCUS LEUCOPUS</em> AND INFECTION RATES BY <em>BORRELLIA</em> IN FRAGMENTED VIGINIA LANDSCAPE</td>
<td>Chelyl L. Tanner, Frank K. Ammer, Ronald E. Barry, and Ellen Y. Stromdahl</td>
</tr>
<tr>
<td>35.</td>
<td>LISTENING IN THE DARK: THE MORPHOLOGY OF FLYING SQUIRREL BULLAE</td>
<td>Richard W. Thorington, Jr. and James F. Whatton</td>
</tr>
<tr>
<td>36.</td>
<td>MITOCHONDRIAL DNA VARIATION IN THE EASTERN GRAY SQUIRREL (<em>SCIURUS CAROLINENSIS</em>)</td>
<td>Nancy D. Moncrief, Ronald A. Van Den Bussche, and Jesus E. Maldonado</td>
</tr>
<tr>
<td>38.</td>
<td>MULTI-SPECIES OCCUPANCY AND DETECTION OF SYMPATRIC MESOCARNIVORES IN SOUTHERN ILLINOIS</td>
<td>Damon B. Lesmeister, Clayton K. Nielsen, Eric M. Schauber, and Eric C. Hellgren</td>
</tr>
<tr>
<td>39.</td>
<td>DISPERSAL IN A SOCIAL CARNIVORE (<em>NASUA NARICA</em>): TROPICAL VERSUS TEMPERATE TRENDS</td>
<td>Maureen E. McColgin, John L. Koprowski, and Peter M. Waser</td>
</tr>
<tr>
<td>40.</td>
<td>LIFE ON THE EDGE: PERSISTENCE OF THE MONTANE VOLE, <em>MICROTUS MONTANUS</em> IN A CHANGING CLIMATE</td>
<td>Dolly Crawford</td>
</tr>
<tr>
<td>41.</td>
<td>SYSTEMATICS AND DISTRIBUTION OF SHORT-TAILED SHREWS (<em>BLARINA</em>) IN ALABAMA</td>
<td>Jeremy A. White, Vicki A. Peterson, and Anne-Marie C. Hodge</td>
</tr>
<tr>
<td>42.</td>
<td>MICROSALELLITE CHARACTERIZATION IN <em>SPERMOPHILUS TERETICAUDUS</em></td>
<td>Karan E. Munroe and John L. Koprowski</td>
</tr>
<tr>
<td>43.</td>
<td>COMPARING ENERGETICS AND COST OF TRANSPORT OF <em>GLAUCOMYS SABRINUS</em> AND <em>SCUIRUS NIGER</em></td>
<td>Elizabeth A. Flaherty, Merav Ben-David, and Winston P. Smith</td>
</tr>
<tr>
<td>44.</td>
<td>THE MATING SYSTEM OF <em>CROCIDURA SHANTUNGENSIS</em> IN A SALT MARSH IN NORTHERN TAIWAN</td>
<td>Ting-Ting Lin and Yu-The K. Lin</td>
</tr>
</tbody>
</table>
## DETAILED PROGRAM

<table>
<thead>
<tr>
<th>45. WHAT ARE THE VERRUCAE THAT ADORN LIPS AND CHINS OF PHYLLOSTOMID BATS?</th>
<th>Gary G. Kwiecinski and Paul J. Homnick</th>
</tr>
</thead>
<tbody>
<tr>
<td>46. MOVEMENT PATHWAYS OF MEADOW JUMPING MICE AS REVEALED BY POWDER-TRACKING</td>
<td>Rebecca Norris, Daniel Warren, Carly Andrews, Daniel Hollern, Hillary Johnson, Maegen Kish, Nicholas Rubino, Stephanie Trela, and Joe Jacquot</td>
</tr>
<tr>
<td>47. TIME ENERGY BUDGETS OF CATIVE NORTHERN FLYING SQUIRRELS IN A SEMI-NATURAL ENCLOSURE</td>
<td>Mike Logan and John Scheibe</td>
</tr>
<tr>
<td>48. EFFECTS OF A WESTERN DIET ON MASS, BODY FAT, AND BLOOD GLUCOSE OF <em>NEOTOMA MICROPUS</em></td>
<td>Lacey Harbour, Diane Post, Lucy Caudillo, and Joseph Schenkman</td>
</tr>
<tr>
<td>49. IMPORTANCE OF RESIDENT ENVIRONMENTAL AWARENESS IN CONSERVATION OF URBAN WILDLIFE POPULATIONS</td>
<td>Anita T. Morzillo</td>
</tr>
<tr>
<td>50. BEHAVIORAL DIFFERENCES OF <em>NEOTOMA MICROPUS</em> FROM SITES THAT DIFFER IN LEVELS OF HUMAN DISTURBANCE</td>
<td>Lucy Caudillo, Diane Post, Lacey Harbour, and Joseph Schenkman</td>
</tr>
<tr>
<td>51. SEASONAL DEN USE OF THE NORTH AMERICAN PORCUPINE (<em>ERETHIZON DORSATUM</em>) IN NORTHERN NEW YORK</td>
<td>Christopher M. Neill and Erika L. Barthelmess</td>
</tr>
<tr>
<td>52. SMALL MAMMAL COMMUNITY RESPONSE TO RECLAMATION FOLLOWING MOUNTAINTOP REMOVAL IN EASTERN KENTUCKY</td>
<td>John K. Sanders and Joseph C. Whittaker</td>
</tr>
<tr>
<td>53. LAUNCH KINEMATICS IN SUGAR GLIDERS (<em>PETAURUS BREVICEPS</em>)</td>
<td>John S. Scheibe and Craig Gump</td>
</tr>
<tr>
<td>54. DIET ANALYSIS OF A MATERNAL COLONY OF BIG BROWN BATS (<em>EPTESICUS FUSCUS</em>) IN FLOYD COUNTY, KENTUCKY</td>
<td>James Williams and Joseph C. Whittaker</td>
</tr>
<tr>
<td>55. PALEOEKOLOGICAL DIVERSITY OF QUATERNARY CAVES IN CENTRAL PENNSYLVANIA: A METHODOLOGY</td>
<td>Brian P. Tanis and Carlos A. Iudica</td>
</tr>
<tr>
<td>56.</td>
<td>EMERGENCE TIME OF <em>MYOTIS LUCIFUGUS</em>: EFFECT OF BODY MASS AND CLIMATIC CONDITIONS</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
|     | Amanda F. Janicki and Carlos A. Iudica [

<table>
<thead>
<tr>
<th>57.</th>
<th>SHE LOVES ME, SHE LOVES ME NOT: FEMAL MATE PREFERENCES IN A WOODRAT HYBRID ZONE</th>
</tr>
</thead>
</table>
|     | Quinn R. Shurtleff and Marjorie D. Matocq [

<table>
<thead>
<tr>
<th>58.</th>
<th>THE SPACE-TIME CONTINUUM AND RESPONSES BY SMALL MAMMALS TO FOREST-MANAGEMENT EXPERIMENTS</th>
</tr>
</thead>
</table>
|     | Robert A. Gitzen, Stephen D. West, Keith B. Aubry, Joshua J. Millspaugh, and Michael R. Kroeger [

<table>
<thead>
<tr>
<th>59.</th>
<th>USE OF FLUORESCENT DYE FOR DETERMINATION OF DIFFERENTIAL LOG USE OF <em>PEROMYSCUS</em> SPP., <em>MYODES GAPPERI</em>, AND <em>ZAPUS HUDSONIUS</em> IN ITASKA STATE PARK, MINNESOTA</th>
</tr>
</thead>
</table>
|     | Peter V. Gailans and Joseph C. Whittaker [

<table>
<thead>
<tr>
<th>60.</th>
<th>MODELING THE SPATIALLY EXPLICIT ANIMAL RESPONSE TO COMPOSITION OF HABITAT (SEARCH)</th>
</tr>
</thead>
</table>
|     | Benjamin P. Pauli, Nicholas P. McCann, Robert Cummings, and Patrick A. Zollner [

<table>
<thead>
<tr>
<th>61.</th>
<th>REINTRODUCTION OF THE STATE-ENDANGERED EASTERN WOODRAT (<em>NEOTOMA FLORIDANA ILLINOENSIS</em>)</th>
</tr>
</thead>
</table>
|     | Aaron K. Poole, David Ing, Timothy C. Carter, Brian A. Novosak, and George A. Feldhamer [

<table>
<thead>
<tr>
<th>62.</th>
<th>CRANIOMETRIC VARIATION IN CALIFORNIA VOLES (<em>MICROTUS CALIFORNICUS</em>)</th>
</tr>
</thead>
</table>
|     | Chris J. Conroy [

<table>
<thead>
<tr>
<th>63.</th>
<th>SURVIVAL OF PRONGHORNS IN WESTERN SOUTH DAKOTA</th>
</tr>
</thead>
</table>
|     | Christopher N. Jacques, Jonathan A. Jenks, Jaret D. Sievers, and Daniel E. Roddy [

<table>
<thead>
<tr>
<th>64.</th>
<th>ACTIVITY PATTERNS OF MIGRATORY BATS IN MINNESOTA</th>
</tr>
</thead>
</table>
|     | Gerda E. Nordquist, Kelly L. Pharis, Christi A. Spak, and Aren M. Gunderson [

<table>
<thead>
<tr>
<th>65.</th>
<th>MODELING OCCUPANCY OF AMERICAN MARTEN (<em>MARTES AMERICANA</em>) ACCOUNTING FOR SPATIAL EXPLICIT VARIABLE</th>
</tr>
</thead>
</table>
|     | Chia-Chun Tsai, Patrick A. Zollner, Jonathon H. Gilbert, Bronwyn W. Williams, Kim Scribner, Timothy S. White, Jim Woodford, and Daniel Eklund [

<table>
<thead>
<tr>
<th>66.</th>
<th>MODELING OF SWAMP RABBIT (<em>SYLVILAGUS AQUATICUS</em>) DISTRIBUTION IN SOUTHEAST MISSOURI</th>
</tr>
</thead>
</table>
|     | Erin Fanning and Vicki Jackson [


### DETAILED PROGRAM

<table>
<thead>
<tr>
<th>67. ROOST SITE USE AND SELECTION BY RAFINESQUE’S BIG-EARED BATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susan C. Loeb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>68. FACULTATIVE MUTUALISM OR COMPETITION BETWEEN O. NUTTALLI AND P. LEUCOPUS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary W. Barrett and Laura A. Gibbes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>69. ARE WHITE-FOOTED MICE MORE ABUNDANT IN THE INTERIOR THAN IN THE EDGES OF FOREST FRAGMENTS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gregg Marcello, Grant Sizemore, and Douglas B. Meikle</td>
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</table>

#### Sunday

<table>
<thead>
<tr>
<th>5:00-7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Mixer—Performing Arts Center</td>
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<thead>
<tr>
<th>5:00-7</th>
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<td>Dinner (on your own)</td>
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<thead>
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<th>7-11</th>
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<tbody>
<tr>
<td>Social—Performing Arts Center</td>
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#### Monday

<table>
<thead>
<tr>
<th>8:00</th>
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<tbody>
<tr>
<td>Technical Session 4 – Biogeography 2</td>
</tr>
<tr>
<td>Rotunda A</td>
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<tr>
<td>Chair: Amy Lewis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Session 5 – Morphology</td>
</tr>
<tr>
<td>Rotunda G</td>
</tr>
<tr>
<td>Chair: Susan Rupp</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Session 6 – Population Ecology 2</td>
</tr>
<tr>
<td>Rotunda D</td>
</tr>
<tr>
<td>Chair: Dave Knudsen</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>70. PHYLOGENETIC STATUS AND POPULATION GENETIC STRUCTURE OF THE ARIZONA SHREW (SOREX ARIZONAE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jorge Ortega, Sarah Young, Lee H. Simons, Sheridan Stone, and Jesús E. Maldonado</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>77. THE BASICRANIAL ANGLE AND HEAD CARRIAGE IN GLIRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. O. Landry</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>84. ENVIRONMENTAL CORRELATES OF SURVIVAL AND REPRODUCTION IN OLD-FIELD RODENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norman A. Slade and Aaron W. Reed</td>
</tr>
</tbody>
</table>
# Detailed Program

| Monday 8:15 | 71. THE CONTACT ZONE BETWEEN TWO SPECIES OF SHORT-TAILED SHREW (*BLARINA*) IN IOWA AND MISSOURI  
Cody W. Thompson, Russell S. Pfau, Elmer J. Finck, Jerry R. Choate, and Hugh H. Genoways | 78. MULTIVARIATE MORPHOLOGICAL ANALYSIS OF NICHE PARTITIONING AMONG COSTA RICAN BATS  
Lorelei E. Patrick and Luis A. Ruedas | 85. SMALL MAMMAL RESPONSE VARYING AMOUNTS OF WOODY VEGETATION IN SHORTGRASS PRAIRIE  
Cassie L. Cox and Raymond S. Matlack |
| --- | --- | --- | --- |
| Monday 8:30 | 72. POSTGLACIAL EXPANSION OF *URODERMA BILOBATUM* (CHIROPTERA: PHYLLOSTOMIDAE) IN THE NEOTROPICS  
Hugo Mantilla-Meluk and Robert J. Baker | 79. THE RELATION OF TRAGUS SIZE EXTERNAL EAR MORPHOLOGY TO FORAGING ECOLOGY IN PHYLLOSTOMIDAE  
Meredith A. Magnuson, Zachary P. Roehrs, and Karen McBee | 86. SEX-SPECIFIC RESPONSES OF NORTH AMERICAN ELK TO FUELS REDUCTION  
Ryan A. Long, Janet L. Rachlow, John G. Kie, and R. Terry Bowyer |
| Monday 8:45 | 73. BIOGEOGRAPHY OF SOUTHERN LESSER ANTILLEAN BATS  
Nicté Ordóñez-Garza, John O. Matson, Jorge Salazar-Bravo | 87. INFLUENCE OF SAMPLING INTENSITY AND LANDSCAPE VARIABLES ON PROBABILITY OF SITE OCCUPANCY OF EASTERN FOX SQUIRRELS  
Joseph B. Dumyahn, Chia-Chun Tsai, and Patrick A. Zollner |
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td><strong>74. BIOGEOGRAPHY AND EVOLUTION OF THE FRUIT BATS, PTEROPODIDAE (CHIROPTERA)</strong></td>
<td>Luis A. Ruedas, Jacob A. Esselstyn, and Juan Carlos Morales</td>
</tr>
<tr>
<td></td>
<td><strong>81. LONGITUDINAL STUDY OF INDIVIDUALLY MARKED SHORT-TAILED SHREWS (BLARINA BREVICAUDA)</strong></td>
<td>B. Diane Chepko-Sade and Sara M. Ressing</td>
</tr>
<tr>
<td></td>
<td><strong>88. SHIFTING FAUNAL COMPOSITION UNDER WOODY ENCROACHMENT: EQUILIBRIUM AND NON-EQUILIBRIUM PERSPECTIVES</strong></td>
<td>Aaron L. Alford, Eric C. Hellgren, Ryan F. Limb, David M. Engle</td>
</tr>
<tr>
<td>9:15</td>
<td><strong>75. POPULATION STRUCTURE OF COMMON VAMPIRE BATS IN ECUADOR: TESTING TRANS-ANDEAN GENE FLOW</strong></td>
<td>C. Miguel Pinto, Hugo Mantilla-Meluk, Steven R. Hoofer, and Robert J. Baker</td>
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<td><strong>82. GEOMETRIC CRANIAL MORPHOMETRIC ANALYSIS OF NON-GEOGRAPHIC VARIATION: A CASE STUDY BASED ON TWO GEOGRAPHICALLY DISPARATE SPECIES, AETHOMYS INEPTUS FROM SOUTHERN AFRICA AND ARVICANTHIS NILOTICUS FROM SUDAN (RODENTIA: MURIDAE)</strong></td>
<td>Eitimad H. Abdel-Rahman, Peter J. Taylor, Giancarlo Contrafatto, Jennifer M. Lamb, Paulette Bloomer, and Christian T. Chimimba</td>
</tr>
<tr>
<td>9:30</td>
<td><strong>76a. SYSTEMATICS AND SPECIES BOUNDARIES OF DERMANURA (PHYLLOSTOMIDAE: STENODERMATINAE)</strong></td>
<td>Sergio Solari, Steven R. Hoofer, Peter A. Larsen, Robert D. Bradley, and Robert J. Baker</td>
</tr>
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<td><strong>83. ARE THERE INDIVIDUAL AND/OR ROOST SIGNATURES IN THE ECHOLOCATION CALLS OF WILD BIG BROWN BATS (EPTESICUS FUSCUS)?</strong></td>
<td>Elisabeth van Stam, M. Brock Fenton, and Thomas J. O’Shea</td>
</tr>
<tr>
<td></td>
<td><strong>90. LANDSCAPE ECOLOGY OF CAPYBARA (HYDROCHAERIS HYDROCHAERIS) IN THE CHACO REGION OF PARAGUAY</strong></td>
<td>Juan M. Campos, Samantha M. Wisely, and Dennis Meritt</td>
</tr>
<tr>
<td>9:45</td>
<td>Refreshment Break – Performing Arts Center</td>
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<tr>
<td>10:00</td>
<td>Members Meeting I – Performing Arts Center</td>
<td></td>
</tr>
</tbody>
</table>
## DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Monday 12:00</th>
<th>Lunch</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday 1:15</strong></td>
<td><strong>SYMPOSIUM— HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY—Kevin C. Rowe (Convener)</strong></td>
</tr>
<tr>
<td>Performing Arts Center</td>
<td></td>
</tr>
<tr>
<td><strong>91. THE HISTORY OF HUMAN DIVERSITY IN AMERICAN MAMMALOGY: HOW HAVE WE CHANGED AND WHAT IS OUR FUTURE?</strong></td>
<td></td>
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<tr>
<td>Dawn M. Kaufman, Division of Biology, Kansas State University</td>
<td></td>
</tr>
<tr>
<td><strong>92. HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: HUMAN DIVERSITY IN SOUTH DAKOTA</strong></td>
<td></td>
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<tr>
<td>Allen R. Branum, Director for Diversity Enhancement, South Dakota State University</td>
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</tr>
<tr>
<td><strong>93. HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: INDIGENOUS DIVERSITY OF THE NORTHERN PLAINS</strong></td>
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<tr>
<td>Valerian Three Irons, International Partnership for Service-Learning and Leadership Lakota Studies Program Director, and Diversity Associate, South Dakota State University</td>
<td></td>
</tr>
<tr>
<td><strong>94. A COLLABORATIVE EFFORT AND A PIPELINE APPROACH TO INCREASING RETENTION OF UNDERREPRESENTED MINORITIES IN THE SCIENCES</strong></td>
<td></td>
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<tr>
<td>Brett C. Woods and Jeffrey S. McKinnon, Beloit College (BCW), University of Wisconsin-Whitewater (JSM)</td>
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<tr>
<td><strong>Panel Discussion—Performing Arts Center</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Monday 3:15</strong></td>
<td><strong>Refreshment Break—Performing Arts Center</strong></td>
</tr>
</tbody>
</table>
## DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>Authors/Institutions</th>
</tr>
</thead>
</table>
| Technical Session 7 – Physiology | Rotunda A Chair: Gary Kwiecinski | 95. ENVIRONMENTAL INFLUENCES ON THE HIBERNATION PATTERNS OF EASTERN WOODCHUCKS  
Stam. M. Zervanos, Greg L. Florant, Christ Maher, and Jerry A. Waldvogel |
| Monday 3:45 |                                                                      |                                                                                     |
| Technical Session 8 – Conservation | Rotunda G Chair: Janet Rachlow | 101. TRAPPING STUDY OF THE ENDANGERED KEY LARGO COTTON MOUSE: A METHOD FOR LONG-TERM POPULATION MONITORING  
Daniel U. Greene, Michael T. Mengak, and Steve Castleberry |
| Monday 4:00 |                                                                      |                                                                                     |
| Technical Session 9 – Population Ecology 3 | Rotunda D Chair: Dorothy Fecske | 107. LIFE IN THE URBAN MATRIX: DEMOGRAPHIC PATTERNS OF RACCOONS IN THE CHICAGO METROPOLITAN AREA  
William H. Graser and Stanley D. Gehrt |
| Monday 4:15 |                                                                      |                                                                                     |
| Technical Session 10 – Ecology 1 | Rotunda E Chair: Charles Bruseth | 108. HOME RANGES OF EXOTIC ABERT’S SQUIRRELS IN BURNED AND UNBURNED FOREST: IMPLICATIONS FOR CONSERVATION  
Nathan Gwinn and John L. Koprowski |
| Monday 4:30 |                                                                      |                                                                                     |
| Technical Session 11 – Ecology 2 | Rotunda F Chair: Stephen Smith | 109. STATUS AND MANAGEMENT OF COUGARS IN NORTH DAKOTA  
Dorothy M. Fecske, Daniel J. Thompson, Jonathan A. Jenks, and Mike Oehler |
| Monday 4:45 |                                                                      |                                                                                     |
| Technical Session 12 – Conservation | Rotunda G Chair: Janet Rachlow | 110. EFFECTS OF WILDFIRE AND FOREST HARVEST ON NORTH AMERICA SMALL MAMMALS – A METAANALYSIS  
Rafal Zwolak |
| Monday 5:00 |                                                                      |                                                                                     |
## DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday 4:45</td>
<td><strong>99. THERMOREGULATORY ADVANTAGES OF SHADE USE BY DESERT BIGHORN SHEEP</strong></td>
<td>James W. Cain, III, Brian D. Jansen, Ryan R. Wilson, and Paul R. Krausman</td>
</tr>
<tr>
<td>Monday 5:00</td>
<td><strong>100. USING STABLE CARBON AND NITROGEN ISOTOPES TO INFER SEASONAL DIETARY CHANGES AND NICHE SEPARATION BETWEEN DEER MICE AND WHITE-FOOTED MICE IN SOUTHEASTERN SOUTH DAKOTA</strong></td>
<td>Rachel L. DeMots, James M. Novak, Karen Gaines, and Christopher S. Romanek</td>
</tr>
<tr>
<td>Monday 5:00</td>
<td><strong>105. UNDERSTANDING FLUCTUATIONS IN BOBCAT HARVEST AT THE NORTHERN LIMIT OF THEIR RANGE</strong>*</td>
<td>Maxime Lavoie and Serge Larivière</td>
</tr>
<tr>
<td>Monday 5:00</td>
<td><strong>106. AN INTRODUCED POPULATION OF MEXICAN RED-BELLED SQUIRRELS IN BISCAYNE NATIONAL PARK, FLORIDA, USA</strong></td>
<td>Geoffrey H. Palmer and John L. Koprowski</td>
</tr>
<tr>
<td>Monday 5:00</td>
<td><strong>111. EFFECTS OF FIRE ON THE SMALL MAMMAL COMMUNITY AND VEGETATION OF A TALLGRASS BLACKLAND PRAIRIE IN TX.</strong></td>
<td>B. N. Kirchner and K. T. Wilkins</td>
</tr>
<tr>
<td>Monday 5:00</td>
<td><strong>112. ASSESSING STRESS IN THE ENDANGERED INDIANA BAT USING FECAL CORTISOL ASSAYS</strong></td>
<td>Christopher S. Richardson, Matthew G. Hohmann, Thomas H. Kunz, Brian D. Shaller, and Eric P. Widmaier</td>
</tr>
<tr>
<td>Monday 6-9 p.m.</td>
<td>Picnic –Skinner’s Bar Downtown Brookings</td>
<td></td>
</tr>
</tbody>
</table>

### TUESDAY

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 8-10 a.m.</td>
<td><strong>113. TAXONOMIC STATUS OF THE DAVIS MOUNTAINS COTTONTAIL, SYLILAGUS ROBUSTUS (LAGOMORPHA, LEPORIDAE)</strong></td>
<td>Dana Lee, Loren K. Ammerman, and Russell Pfau</td>
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<td><strong>114. [Cancelled]</strong></td>
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* Indicates a special session.
<table>
<thead>
<tr>
<th>115. THE TAGGING OF THE SHREW: THE FEASIBILITY OF VISIBLE IMPLANT ELASTOMERS FOR MARKING SMALL MAMMALS</th>
</tr>
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<tbody>
<tr>
<td>Michael S. Rentz and Danielle Garneau</td>
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<thead>
<tr>
<th>116. UPDATE ON THE EMERGENCE OF THE WHITE-NOSED SYNDROME</th>
</tr>
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<tbody>
<tr>
<td>Alan Hicks, Ryan Vonlinden, Scott R. Darlingg, Susi von Oettingen, Robyn Niver, and C. William Kilpatrick</td>
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<thead>
<tr>
<th>117. DISTRIBUTION AND PHYLOGEOGRAPHY OF NORTH AMERICA’S MOST REMOTE AND POORLY STUDIED SCIURID, THE ALASKA MARMOT (MARMOTA BROWERI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aren M. Gunderson and Link E. Olson</td>
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<thead>
<tr>
<th>118. HABITAT SELECTION AND THE EFFECTS OF FARMSTEAD REMOVAL ON MAMMALIAN WATERFOWL PREDATOR ACTIVITY</th>
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</thead>
<tbody>
<tr>
<td>Justin A. Pitt, Serge Lariviere, Francois Messier, and Mark S. Boyce</td>
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<tr>
<th>119. USING MICROSATELLITES TO DETECT BOBCAT POACHING IN MICHIGAN</th>
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<tr>
<td>Katelyn I. Schumacher and Bradley J. Swanson</td>
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<tr>
<th>120. HIBERNATION: AROUSAL AND RECOVERY FROM ADAPTIVE RENAL FAILURE</th>
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<td>Clark J. Cotton</td>
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<thead>
<tr>
<th>121. CHECKLIST AND NOTEWORTHY RECORDS OF ECUADORIAN BATS</th>
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<tr>
<td>Juan P. Carrera and Luis Albuja V.</td>
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<thead>
<tr>
<th>122. HOW DOES ANNUAL BURNING AFFECT THE SMALL MAMMAL COMMUNITY IN TALLGRASS PRAIRIE: A LONG-TERM STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glennis a. Kaufman, Dawn M. Kaufman, and Donald W. Kaufman</td>
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<tr>
<th>123. SPATIAL-TEMPORAL DISTRIBUTION OF DIVERSITY: SMALL MAMMALS ON KONZA PRAIRIE</th>
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</thead>
<tbody>
<tr>
<td>Donald W. Kaufman, Glennis A. Kaufman, and Dawn M. Kaufman</td>
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<tr>
<th>124. SEASONAL USE OF A GAS PIPELINE RIGHT-OF-WAY</th>
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<tr>
<td>Robert Dawley, Julie Balko, Megan Herr, Schartel Tyler, and Ellen Dawley</td>
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<tr>
<th>125. PATCHY DISTRIBUTION OF BATS</th>
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</thead>
<tbody>
<tr>
<td>Scott C. Pedersen</td>
</tr>
<tr>
<td>126. CACHE RECOVERY, PILFERING AND SPATIAL MEMORY IN A SCATTER-HOARDING ROADENT: DO HOARDERS HAVE A RECOVE</td>
</tr>
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<tr>
<td>127. PREDICTIVE MODEL FOR DEER-VEHICLE COLLISIONS BASED ON LANDSCAPE AND TOPOGRAPHICAL FEATURES</td>
</tr>
<tr>
<td>128. ISOTOPOCALLY ENRICHED BAITS TO NON-INVASIVELY MARK FREE-RANGING CARNIVORES</td>
</tr>
<tr>
<td>129. COMPARING MOVEMENT OF EASTERN CHIPMUNKS RELEASED CLOSE TO ROADS OF VARYING TRAFFIC VOLUME</td>
</tr>
<tr>
<td>130. PRELIMINARY PHYLOGENETIC ASSESSMENT OF THE MINIMUS SPECIES GROUP (TAMIAS)</td>
</tr>
<tr>
<td>131. THE ROLE OF COMPETITION IN STRUCTURING A NEOTROPICAL BAT ASSEMBLAGE</td>
</tr>
<tr>
<td>132. GENETIC IMPACT OF HABITAT FRAGMENTATION ON AMERICAN BADGER (TAXIDAE TAXUS) POPULATIONS</td>
</tr>
<tr>
<td>133. FACTORS AFFECTING JUVENILE SURVIVAL OF PYGMY RABBITS (BRACHALAGUS IDAHOENSIS)</td>
</tr>
<tr>
<td>134. NESTING AND BURROWING MATERIAL PREFERENCES AND ACTIVITIES OF CAPTIVE GRASSHOPPER MICE</td>
</tr>
<tr>
<td>135. ESTIMATING SITE OCCUPANCY OF UNGULATES IN MID-TAIWAN AND DETECTION PROBABILITY BASED ON AUTO-SENSING CAMERA DATA</td>
</tr>
<tr>
<td>136. SMALL MAMMAL COMMUNITIES ALONG HIGHWAYS: SPECIES COMPOSITION AND BEHAVIOR</td>
</tr>
<tr>
<td>137.</td>
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</tbody>
</table>
| 138. | GENETIC STRUCTURE OF STRIPED SKUNK (*MEPHITIS MEPHITIS*) IN AN URBAN LANDSCAPE  
Jason A. Sumners, Randy W. DeYoung, Denise M. Ruffino, and Scott E. Henke |
| 139. | TRAPPING IN NEWFOUNDLAND'S LABRADOR REGION: WHERE WERE THE DEER MICE?  
David W. Hale |
| 140. | SURVIVORSHIP OF AMERICAN MARTEN IN THE BLACK HILLS, SOUTH DAKOTA  
Joshua B. Smith, Jonathan A. Jenks, Robert W. Klaver, and Dorothy M. Fecske |
| 141. | IMMUNE FUNCTION DURING HIBERNATION IN BIG BROWN BATS (*EPTESICUS FUSCUS*)  
Roymon Jacob and DeeAnn M. Reeder |
| 142. | RESPONSE TO CATURE VARIES BY REPRODUCTIVE STATE BUT NOT CAPTURE METHOD IN LITTLE BROWN BATS (*MYOTIS LUCIFGUS*)  
Megan E. Vodzak, Angela G. Remeika, Scott M. Wasilko, and DeeAnn M. Reeder |
| 143. | RECOVERY OF GRAY WOLVES IN THE GREAT LAKES REGION OF THE UNITED STATES  
Adrian Wydeven, Tim Van Deelen, and Ed Heske |
| 144. | HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: A REVIEW OF ASM PROGRAMS FACILITATING PARTICIPATION  
Kevin C. Rowe, Dawn M. Kaufman, Laurie J. Dizney, Chris M. T. Himes, Clara B. Jones, Donald W. Kaufman, Deanna L. Martinez, Karen McBee, I. Morty Ortega, Oliver R. W. Prgrams, Jorge A. Salazar-Bravo, Cody W. Thompson, Corey K. Welch, Dou-Shuan Yang, and Claire A. Zugmeyer |
| 145. | ASM-AIBS PUBLIC POLICY FELLOWSHIP  
Joshua B. Smith |
| 146. | MEXICAN FOX SQUIRREL USE OF FIRE-IMPACTED FOREST  
Sandra L. Doumas and John L. Koprowski |
### DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 10:00</td>
<td>Group Photo (Performing Arts Center) and Refreshment Break</td>
<td>Performing Arts Center</td>
</tr>
<tr>
<td>Tuesday 10:30</td>
<td>Members Meeting II</td>
<td>— Performing Arts Center</td>
</tr>
<tr>
<td>Tuesday 12:00</td>
<td>Lunch (and 2nd Board of Director’s Lunch)</td>
<td>— Performing Arts Center</td>
</tr>
<tr>
<td>Tuesday 1:30</td>
<td>SYMPOSIUM—GREAT PLAINS MAMMALS</td>
<td>— Scott Pedersen (Convener) — Performing Arts Center</td>
</tr>
<tr>
<td>Tuesday 1:30</td>
<td>149. CONTEMPORARY LAND CHANGE IN THE GREAT PLAINS: RESPONSES TO CLIMATE, ECONOMICS, TECHNOLOGY, AND PUBLIC POLICY</td>
<td>Thomas R. Loveland, U.S. Geological Survey Earth Resources Observation and Science Center, Sioux Falls, SD 57198</td>
</tr>
<tr>
<td>Tuesday 1:50</td>
<td>150. PREDICTING GEOGRAPHIC RANGE EXPANSION OF GREAT PLAINS MAMMALS WITH SPECIES DISTRIBUTION MODELING</td>
<td>Justin D. Hoffman, School of Natural Resources, University of Nebraska-Lincoln</td>
</tr>
<tr>
<td>Tuesday 2:10</td>
<td>151. BIODIVERSITY IN THE GREAT PLAINS: WILL CLIMATE AND LAND-USE CHANGE IMPACT SMALL MAMMALS?</td>
<td>Donald W. Kaufman and Glennis A. Kaufman, Division of Biology, Kansas State University</td>
</tr>
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### DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>Tuesday</td>
<td>152. IMPORTANCE OF LONG DISTANCE DISPERSAL TO CONSERVATION OF SWIFT FOX IN THE NORTHERN GREAT PLAINS</td>
</tr>
<tr>
<td>2:30</td>
<td>Kevin Honness, Jonathan A. Jenks, Shaun Grassel, Greg M. Schroeder, Robert W. Klaver, Kyran E. Kunkel, TESF (KH), SDSU (JAJ), UI (SG), EROS (RWK), WWF (KEK)</td>
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<tr>
<td>Tuesday</td>
<td>Refreshment Break—Performing Arts Center</td>
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<tr>
<td>2:50</td>
<td>Technical Session 10 –Behavior/Reproduction</td>
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<td></td>
<td>Rotunda A</td>
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<td>Chair: Ron Barry</td>
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<tr>
<td>Tuesday</td>
<td>153. DO REPRODUCTIVE DELAYS FACILITATE SPERM COMPETITION? WHAT MUSEUM SPECIMENS CAN TELL US ABOUT SEXUAL SELECTION</td>
</tr>
<tr>
<td>3:15</td>
<td>Teri J. Orr and Marlene Zuk</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Technical Session 11 –Urban Ecology</td>
</tr>
<tr>
<td>3:30</td>
<td>Rotunda G</td>
</tr>
<tr>
<td></td>
<td>Chair: Dave Knudsen</td>
</tr>
<tr>
<td>Tuesday</td>
<td>154. PARTURITION, MOVEMENTS, AND RESOURCE SELECTION IN MULE DEER</td>
</tr>
<tr>
<td>3:30</td>
<td>John Kie, Ryan Long, and R. Terry Bowyer</td>
</tr>
<tr>
<td></td>
<td>155. ESTIMATING DENSITIES FROM SMALL MAMMAL SURVEY DATA: AN EXAMPLE USING DISTANCE SAMPLING METHODOLOGY AT FT. CHAFFEE MILITARY TRAINING CENTER, ARKANSAS</td>
</tr>
<tr>
<td></td>
<td>Thomas E. Nupp</td>
</tr>
<tr>
<td>Tuesday</td>
<td>156. KANSAS MAMMAL ATLAS: RESULTS TO DATE</td>
</tr>
<tr>
<td>3:30</td>
<td>Kendra L. Phelps, Jerry R. Choate, Curtis J. Schmidt, Travis W. Taggart, and Melissa G. Johann</td>
</tr>
<tr>
<td></td>
<td>160. NOCTURNAL BEHAVIOR AND ROOSTING ECOLOGY OF PERIMYOTIS SUBFLAVUS (EASTERN PIPISTRELLE) NEAR INDIANAPOLIS INTERNATIONAL AIRPORT</td>
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<tr>
<td></td>
<td>Jared S. Helms, Dale W. Sparks, and John O. Whitaker, Jr.</td>
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<tr>
<td></td>
<td>166. KANSAS MAMMAL ATLAS: RESULTS TO DATE</td>
</tr>
<tr>
<td></td>
<td>Curtis J. Schmidt, Jerry R. Choate, Kendra L. Phelps, Travis W. Taggart, and Melissa G. Johann</td>
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# DETAILED PROGRAM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Title</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tuesday 4:00</strong></td>
<td><strong>156.</strong> WHAT’S LOVE GOT TO DO WITH IT?</td>
<td>[1.51] DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA</td>
<td>Nancy G. Solomon and Brian Keane</td>
</tr>
<tr>
<td><strong>Tuesday 4:30</strong></td>
<td><strong>158.</strong> FREQUENCY OF MULTIPLE MATING BY FEMALE RICHARDSON’S GROUND SQUIRRELS</td>
<td>[1.53] FREQUENCY OF MULTIPLE MATING BY FEMALE RICHARDSON’S GROUND SQUIRRELS</td>
<td>Nora Magyara and Gail R. Michener</td>
</tr>
<tr>
<td><strong>Tuesday 4:45</strong></td>
<td><strong>159.</strong> THE EFFECTS OF BIODEIVERSITY ON ZOONOTIC DISEASE AND THE IMPLICATIONS FOR CONSERVATION</td>
<td>[1.54] ALTERRED PREDATOR-PREY RELATIONSHIP IN URBAN LANDSCAPES: THE COYOTE AND THE GOOSE</td>
<td>Justin Brown and Stanley D. Gehrt</td>
</tr>
<tr>
<td><strong>Tuesday 5:00</strong></td>
<td><strong>160.</strong> ALTERRED PREDATOR-PREY RELATIONSHIP IN URBAN LANDSCAPES: THE COYOTE AND THE GOOSE</td>
<td>[1.55] ALTERRED PREDATOR-PREY RELATIONSHIP IN URBAN LANDSCAPES: THE COYOTE AND THE GOOSE</td>
<td>Laurie Dizney, Philip D. Jones, and Luis A. Ruedas</td>
</tr>
<tr>
<td><strong>Tuesday 5:15</strong></td>
<td><strong>161.</strong> DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA</td>
<td>[1.56] DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA</td>
<td>Alison Willingham, Stan Gehrt, and Chris Anchor</td>
</tr>
<tr>
<td><strong>Tuesday 5:30</strong></td>
<td><strong>162.</strong> DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA</td>
<td>[1.57] DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA</td>
<td>S. R. Sheffield</td>
</tr>
<tr>
<td><strong>Tuesday 5:45</strong></td>
<td><strong>163.</strong> HOME RANGE SIZE OF VIRGINIA OPOSSUM (<em>DIDELPHIS VIRGINIANA</em>) WITHIN AN URBAN ENVIRONMENT</td>
<td>[1.58] HOME RANGE SIZE OF VIRGINIA OPOSSUM (<em>DIDELPHIS VIRGINIANA</em>) WITHIN AN URBAN ENVIRONMENT</td>
<td>Jeffrey D. Wright and M. Scott Burt</td>
</tr>
<tr>
<td><strong>Tuesday 6:00</strong></td>
<td><strong>164.</strong> HOME RANGE SIZE OF VIRGINIA OPOSSUM (<em>DIDELPHIS VIRGINIANA</em>) WITHIN AN URBAN ENVIRONMENT</td>
<td>[1.59] HOME RANGE SIZE OF VIRGINIA OPOSSUM (<em>DIDELPHIS VIRGINIANA</em>) WITHIN AN URBAN ENVIRONMENT</td>
<td>Robert C. Dowler, Carla E. Ebeling, and Adam W. Ferguson</td>
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**[CANCELLED]**
# DETAILED PROGRAM

| Tuesday 6:00 | Pre-Banquet Social – Volstorff Ballroom — University Student Union |
| Tuesday 6:30 | Banquet – Volstorff Ballroom — University Student Union |
| Tuesday 8:30-11 | Auction and Social – Volstorff Ballroom — University Student Union |

## WEDNESDAY

<table>
<thead>
<tr>
<th>Time</th>
<th>Session 13 – General Ecology</th>
<th>Session 14 – Education/Technology</th>
<th>Session 15 – Biogeography/Genetics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotunda A</td>
<td>Chair: Terry Bowyer</td>
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<td></td>
<td>171. INDIRECT FITNESS BENEFITS DO NOT COMPENSATE FOR THE LOSS OF DIRECT FITNESS IN YELLOW-BELLIED MARMOTS Madan K. Oli, and Kenneth B. Armitage</td>
<td>177. CORRECTING MISCONCEPTIONS? ELEMENTARY TEACHERS’ IDEAS OF THIS THING CALLED…”SCIENCE” Barbara J. Shaw and Luis A. Ruedas</td>
<td>183. PLEOCENE PARK: ANCIENT HAPLOTYPES IN CHAETODIPUS FORMOSUS FROM ARIZONA STRIP Mark L. McKnight</td>
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<td>Wednesday 8:15</td>
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<td>Wednesday 8:30</td>
<td><strong>173. CAUSES OF MORTALITY IN RICHARDSON’S GROUND SQUIRRELS</strong></td>
<td>Gail R. Michener</td>
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<td></td>
<td><strong>179. FIELDWORK AND WILDLIFE DISEASES: CONCERNS FOR BOTH HUMAN AND WILDLIFE HEALTH</strong></td>
<td>Krysten L. Schuler and Charles L. Higgins</td>
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<td><strong>185a. ECOLOGY OF RABIES VIRUS EXPOSURE IN BRAZILIAN FREE-TAILED BATS (Tadarida brasiliensis)</strong></td>
<td>Amy S. Turmelle, Louise C. Allen, Felix R. Jackson, Thomas H. Kunz, Charles E. Rupprecht, and Gary F. McCracken</td>
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<td>Wednesday 8:45</td>
<td><strong>174. SOCIAL SUBDIVISION INFLUENCES EFFECTIVE POPULATION SIZE IN THE COLONIAL BREEDING BLACK-TAILED PRAIRIE DOG</strong></td>
<td>Michael Winterrowd, F. Stephen Dobson, John L. Hoogland, and David W. Foltz</td>
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<td><strong>180. DO KANGAROO RATS INDIRECTLY FACILITATE HARVESTER ANTS? IMPLICATIONS OF INTERSPECIFIC SPATIAL PATTERN</strong></td>
<td>Andrew J. Edelman</td>
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<td><strong>186. GENETIC DIVERSITY OF THE NEOTROPICAL RIVER OTTER (LONTRA LONGICAUDIS) IN THE LACANTUN RIVER AND ITS TRIBUTARIES, IN MONTES AZULES, CHIAPAS, MEXICO</strong></td>
<td>Daya Navarrete and Jorge Ortega</td>
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<td>Wednesday 9:00</td>
<td><strong>175. LONG-TERM STUDY OF POPULATION DYNAMICS OF TWO SMALL MAMMAL SPECIES IN THE EVERGLADES</strong></td>
<td>Miguel V. Fernandes, Donald L. DeAngelis, and Michael S. Gaines</td>
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<td><strong>181. CAN MAPPING OF STABLE ISOTOPES IN TISSUE SUPPLEMENT RADIOTELMETRY TO IDENTIFY NUTRITIONAL SINKS FOR LARGE GENERALIST HERBIVORES</strong></td>
<td>W. David Walter and David M. Leslie, Jr.</td>
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<td>Wednesday 9:15</td>
<td><strong>176. SEASONAL CHANGES AND CANALIZATION IN SURVIVAL AND REPRODUCTION OF SMALL MAMMAL POPULATIONS</strong></td>
<td>Aaron W. Reed and Norman A. Slade</td>
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<td><strong>182. EVOLUTIONARY ANALYSIS OF A NEWLY IDENTIFIED ID-LIKE SINE FAMILY IN THE GUINEA PIG GENOME</strong></td>
<td>Brian A. Schaetz, Kevin Bonnney, Lindsey Beitler, and David H. Kass</td>
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<td><strong>187b. STABLE ISOTOPE OF SMALL MAMMALS IN BURNED AND UNBURNED HABITAT</strong></td>
<td>Yeen Ten Hwang and John S. Millar</td>
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<td><strong>Refreshment Break – Performing Arts Center</strong></td>
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<td>Time</td>
<td>Technical Session 16 – Behavior/Conservation</td>
<td>Technical Session 17 – Mixed</td>
<td>Technical Session 18 – Genetics and Systematics</td>
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<td>10:15</td>
<td>Chair: Teresa Zimmerman</td>
<td>Chair: Link Olson</td>
<td>Chair: Haley Lanier</td>
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<td><strong>188.</strong> EFFECTS OF SEX AND SEASON ON HOME RANGE SIZE OF ARIZONA GRAY SQUIRRELS (SCIURUS ARIZONENSIS)</td>
<td><strong>195.</strong> AGE ANALYSIS AND POPULATION PARAMETERS OF BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) ALONG COASTAL TEXAS: PRELIMINARY ANALYSES</td>
<td><strong>201.</strong> EVOLUTIONARY HISTORY OF THE GENUS CORYNORHINUS</td>
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<td>Nichole L. Cudworth and John L. Koprowski</td>
<td>Rachel Neuenhoff and Christopher D. Marshall</td>
<td>Justin B. Lack and Ronald A. Van Den Bussche</td>
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<td>10:30</td>
<td><strong>189.</strong> SHARING OF ABOVEGROUND AND UNDERGROUND SPACE BY ADULT FEMALE RICHARDSON’S GROUND SQUIRRELS</td>
<td><strong>196.</strong> ECOLOGY OF A MESOCARNIVORE COMMUNITY IN PALO DURO CANYON</td>
<td><strong>202.</strong> [MOVED TO 76a]</td>
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<td>Catherine Ovens and Gail R. Michener</td>
<td>Naima Montacer, Raymond S. Matlack, and Andrew Carrano</td>
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<td>10:45</td>
<td><strong>190.</strong> BIGHORN SHEEP LAMBING HABITAT IN THE NEBRASKA PINE RIDGE: DEVELOPMENT AND EVALUATION OF A GIS MODEL</td>
<td><strong>197.</strong> USE AND PERSISTENCE OF PYGMY RABBIT BURROW SYSTEMS: SHIFTS ACROSS SPACE AND TIME</td>
<td><strong>203.</strong> REEVALUATION OF THE TRIBE PLECOTINI BASED ON MITOCHONDRIAL AND NUCLEAR SEQUENCE DATA</td>
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<td>11:00</td>
<td><strong>191.</strong> SEASONAL MOVEMENTS AND HOME RANGE USE BY FEMALE PRONGHORNS IN WESTERN SOUTH DAKOTA</td>
<td><strong>198.</strong> AGE STRUCTURE, GROWTH, AND MORTALITY OF BELUGA IN THE CANADIAN ARCTIC: RESPONSES TO DIFFERENT ENVIRONMENT AND DENSITY?</td>
<td><strong>204.</strong> REEVALUATION OF THE TRIBE PLECOTINI BASED ON MITOCHONDRIAL AND NUCLEAR SEQUENCE DATA</td>
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<td>Christopher N. Jacques, Jonathan A. Jenks, and Robert W. Klaiver</td>
<td>Sebastian P. Luque and Steven H. Ferguson</td>
<td>Zachary P. Roehrs, Justin B. Lack, and Ronald A. Van Den Bussche</td>
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## DETAILED PROGRAM

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<th>Time</th>
<th>Session</th>
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<tr>
<td><strong>Wednesday 11:15</strong></td>
<td><strong>192. WINTER HABITAT SELECTION OF FREE RANGING ELK IN THE BRUCELOSIS ENDEMIC AREA OF WYOMING WITH RESPECT TO HABITAT IMPROVEMENT AREAS IN THE BUFFALO VALLEY</strong></td>
<td>F. Drew Henry and W. Sue Fairbanks</td>
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<td><strong>199. INTERACTIONS BETWEEN BISON, ELK, AND PLANT COMMUNITIES IN AN ONGOING TALLGRASS PRAIRIE RECONSTRUCTION EFFORT</strong></td>
<td>Barbera W. Kagima and W. Sue Fairbanks</td>
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<tr>
<td><strong>Wednesday 11:30</strong></td>
<td><strong>193. ANNUAL USE OF WATER SOURCES BY REINTRODUCED BIGHORN SHEEP: EFFECTS OF SEASON AND DROUGHT</strong></td>
<td>Jericho C. Whiting, R. Terry Bowyer, and Jerran T. Flinders</td>
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<td><strong>200. SPATIAL VARIATION IN POPULATION PERFORMANCE OF BLACK-TAILED PRAIRIE DOGS IN CHIHUAHUA, MEXICO</strong></td>
<td>Rafael Avila-Flores and Stan A. Boutin</td>
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<td><strong>206. GENETIC VARIATION AND STRUCTURE IN THE ENDANGERED MEXICAN LONG-NOSED BAT (LEPTONYCTERIS NIVALIS): MITOCHONDRIAL AND NUCLEAR PERSPECTIVES</strong></td>
<td>Carson M. Brown, Loren K. Ammerman, Rodrigo A. Medellin, Arnulfo Moreno-Valdez, and Russell S. Pfau</td>
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<td><strong>Wednesday 11:45</strong></td>
<td><strong>194. [Moved to 193]</strong></td>
<td><strong>200b. QUANTITATIVE ANALYSES TO DETERMINE OPTIMUM CONSERVATION OPTIONS FOR THE RIGHT WHALE (EUBALAENA GLACIALIS) IN TWO CRITICAL FEEDING HABITATS</strong></td>
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<tr>
<td>Wednesday</td>
<td>Technical Session 19 –Behavior</td>
<td>Rotunda A</td>
<td>Robert Klaver</td>
<td>Technical Session 19 –Behavior</td>
<td>Rotunda A Chair: Robert Klaver</td>
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<td>12:00</td>
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<td>Technical Session 20 –Parasites and Diseases</td>
<td>Technical Session 20 –Parasites and Diseases Chair: Krysten Schuler</td>
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<td>Rotunda G</td>
<td>Krysten Schuler</td>
<td>Technical Session 20 –Parasites and Diseases</td>
<td>Technical Session 20 –Parasites and Diseases Chair: Krysten Schuler</td>
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<td>1:30</td>
<td>207. TESTING YELLOWSTONE NATIONAL PARK’S MULTGENERATIONAL LARGE-MAMMAL DEATH ASSEMBLAGE AS A SOURCE OF HISTORICAL AND CONTEMPORARY DATA ON UNGULATE HABITAT UTILIZATION</td>
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<td>207. TESTING YELLOWSTONE NATIONAL PARK’S MULTGENERATIONAL LARGE-MAMMAL DEATH ASSEMBLAGE AS A SOURCE OF HISTORICAL AND CONTEMPORARY DATA ON UNGULATE HABITAT UTILIZATION</td>
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<td>212. THE ROLE OF LANDSCAPE BARRIERS, PATHOGEN EVOLUTION AND HOST ECOLOGY IN RABIES EMERGENCE</td>
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<td>212. THE ROLE OF LANDSCAPE BARRIERS, PATHOGEN EVOLUTION AND HOST ECOLOGY IN RABIES EMERGENCE</td>
<td>Samantha M. Wisely, Heather D. Barton, and Rolan Davis</td>
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<td>219. GENETIC STRUCTURE OF BLACK HILLS COUGARS</td>
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<td>Samantha M. Wisely, Heather D. Barton, and Rolan Davis</td>
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<td>213. FLEA ABUNDANCE AND DISTRIBUTION ON MICE AT FORT CARSON MILITARY RESERVATION, COLORADO</td>
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<td>213. FLEA ABUNDANCE AND DISTRIBUTION ON MICE AT FORT CARSON MILITARY RESERVATION, COLORADO</td>
<td>Helen K. Pigage, Jon C. Pigage, and Roger D. Peyton</td>
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<td>220. RESOURCE SELECTION BY BLACK-FOOTED FERRETS IN SOUTH DAKOTA AND MONTANA</td>
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<td>220. RESOURCE SELECTION BY BLACK-FOOTED FERRETS IN SOUTH DAKOTA AND MONTANA</td>
<td>David S. Jachowski, Joshua J. Millspaugh, Dean E. Biggins, Travis M. Livieri, Marc R. Matchett, and Chadwick D. Rittenhouse</td>
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<td>2:00</td>
<td>209</td>
<td>UNDERSTANDING WHITE-TAILED DEER PRODUCTIVITY: ECOLOGY OF NEONATES IN NORTH-CENTRAL SOUTH DAKOTA</td>
<td>Robert W. Klaver, Troy W. Grovenburg, and Jonathan A. Jenks</td>
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<td>214</td>
<td>[MOVED TO PAPER 185]</td>
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<td>221</td>
<td>EASTERN SPOTTED SKUNK (SPILOGALE PUTORIUS) DENNING AND RESTING ECOLOGY</td>
<td>Damon B. Lesmeister, Matthew E. Gompper, and Joshua J. Millspaugh</td>
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<td>2:15</td>
<td>210</td>
<td>INFLUENCE OF INTR-SPECIFIC COMPETITION AND INDIRECT PREDATION RISK ON THE FORAGING BEHAVIOR OF WHITE-FOOTED MICE</td>
<td>John Yunger and Amaber M. Vallera</td>
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<td>215</td>
<td>MOLECULAR SYSTEMATICS AND HISTORICAL DEMOGRAPHY OF GRAY WHALE LICE: WHAT CAN THEY TELL US ABOUT GRAY WHALES?</td>
<td>Christopher M. Callahan and Brian S. Arbogast</td>
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<td>222</td>
<td>AMERICAN MARTEN SURVIVAL IN NORTHERN WISCONSIN</td>
<td>Nicholas McCann, Jonathan Gilbert and Patrick Zollner</td>
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<td>2:30</td>
<td>211</td>
<td>DOES KINSHIP EXPLAIN VARIATION OF CONTACT RATES AND DEN SHARING OF AN URBAN CARNIVORE, THE RACCON?</td>
<td>Stephanie A. Hauver, Suzanne Prange, Stanley D. Gehrt, and Jena Dubach</td>
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<td>216</td>
<td>PREVALENCE OF PARASITES INCLUDING STRONGYLOIDES ROBUSTUS IN THE STATE ENDANGERED NORTHERN FLYING SQUIRREL (GLAUCOMYS SABRINUS) AND CO-OCCURRING SOUTHERN FLYING SQUIRREL (G. VOLANS) IN PENNSYLVANIA</td>
<td>Andrew VanKuren, Adam Schenk, Carolyn Mahan, Michael Steele, and Gregory Turner</td>
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<td>223</td>
<td>MOVEMENT OF A SOLITARY CARNIVORE IN A PATCHY LANDSCAPE</td>
<td>Emily M. Bade, Clayton K. Nielsen, and Daniel E. Kennedy</td>
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## DETAILED PROGRAM

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| **Wednesday**  
2:45    | **211b. EVALUATION OF AN AUGMENTATION OF BIGHORN SHEEP AT BADLANDS NATIONAL PARK, SOUTH DAKOTA**                                           | Teresa J. Zimmerman, Jonathan A. Jenks, Robert W. Klaver, and David M. Leslie, Jr.             |
|        | **217. MALES SEEKING FEMALES: ANOMALOUS SEX-RATIO BIAS IN BAT PARASITES (DIPTERA: STREBLIDAE)**                                            | Carl W. Dick and Bruce D. Patterson                                                             |
|        | **224. MULTISCALE HOME RANGE SELECTION AND HABITAT ASSOCIATIONS OF BADGERS IN AGRICULTURAL LANDSCAPES**                                   | Jared F. Duquette, Stanley D. Gehrt, Barbara Ver Steeg, and Richard E. Warner                 |
| 3:00   | **211c. CENTRAL-PLACE FORAGING OF FLORIDA MANATEES OVERWINTERING AT A THERMAL REFUGE**                                                    | Charles J. Deutsch, Holly H. Edwards, Margaret E. Barlas, and Paul Carlson                     |
|        | **218. SOUTHERN FLYING SQUIRRELS (GLAUCOMYS VOLANS) AS RESERVOIRS FOR SYLVATIC EPIDEMIC TYPHUS IN THE UNITED STATES: RECENT FINDINGS**     | John W. Krebs, Laurel E. Garrison, Wayne Ford, Marina E. Eremeeva, Jennifer Z. Adjemian,       |
|        |                                                                                                                                          | William L. Nicholson, Kelly A. Pierce, Robert F. Massung, Jennifer H. Mcquiston              |
| 3:15   | **[CANCELLED]**                                                                                                                            |                                                                                               |
| 3:45   | **Refreshment Break – Performing Arts Center**                                                                                             |                                                                                               |
| **Thursday**  
5:00    | **Capstone Presentation—Performing Arts Center**                                                                                           | Douglas W. Smith and Daniel R. Stahler                                                         |
|        | **Final Check-Out Time – Dorms**                                                                                                          |                                                                                               |
1 KINSHIP MEDIATION OF SOUTHERN FLYING SQUIRREL WINTER AGGREGATIONS

Katherine K. Thorington, Wake Forest University, P.O. Box 7325, Winston-Salem, NC 27109 USA

Seasonally gregarious southern flying squirrels (*Glaucomys volans*) face a dilemma: group living is advantageous for energy conservation (thermoregulatory benefit), but may be deleterious to individual survival due to food pilfering by nest mates. Living with kin in winter aggregations may mitigate these deleterious effects as the animals are storing food in a common area, and if an individual dies, its stored food can benefit its relatives. Therefore, genes and behavioral traits associated with wintertime kin-based aggregation will be represented in succeeding generations. Previous experiments showed kinship to be an important factor in winter aggregation formation. I show here that once formed in captivity, winter aggregations persist, and that related and unrelated groups differ in their tolerance for unrelated intruder animals. Additionally my genetic survey of wild-caught groups shows that at a conservative estimate, half of nest groups are significantly related.

2 WHENCE AND WHEN? TESTING DIVERGENCE HYPOTHESES WITHIN PIKAS (GENUS *OCHOTONA*) USING RELAXED MOLECULAR CLOCKS

Hayley C. Lanier, University of Alaska Museum, University of Alaska Fairbanks, Fairbanks, AK 99775 USA

Extant pikas (*Ochotona* spp.) are adapted to cold environments and high latitudes or altitudes. Previous studies have suggested that diversification within the group is linked to Pliocene uplift of the Tibetan Plateau (Asian species) and Pleistocene glaciations (North American species). I used the mitochondrial genes cyt b and ND4 to investigate the origin of the North American lineages and the timing of phylogenetic diversification within *Ochotona*. Previous studies have applied an externally calibrated rate to determine the timing of diversification within the genus. This method has been increasingly shown to return results that at the very least are unrealistically narrow in their confidence intervals, and at the worst, can be entirely spurious. I found no evidence of additional trans-Beringian dispersals into North America, thereby upholding the hypothesis of a single invasion of North America. Date estimates from the application of a strict molecular clock approach return drastically different results from those that are compatible with the data in a relaxed molecular clock analysis. I contrast fossil, biogeographic, and molecular evidence to determine support for competing hypotheses, and demonstrate that the relaxed molecular techniques are more appropriate for *Ochotona*. The major splits within the genus probably occurred in the late Miocene, and, contrary to previous studies, the Nearctic pikas diverged before the Pleistocene. This study emphasizes the importance of using multiple approaches when evaluating divergence hypotheses, and cautions against applying an externally calibrated rate without justification.

3 ANTIPHONAL EXCHANGES ALLOW INDIVIDUAL DISCRIMINATION IN WHITE-WINGED VAMPIRE BATS (*DIAEMUS YOUNGI*)

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In white-winged vampire bats (*Diaemus youngi*), adults emit social calls that are structurally similar to the pup isolation calls found in many other bat species. In addition, *D. youngi* seem to exchange these calls in a duet-like fashion. To determine if calls elicit truly antiphonal responses, I simultaneously recorded groups of 4 captive bats using synchronized microphones. To examine call function, I conducted analyses of individual variation in call structure and a habituation-discrimination playback experiment. I demonstrated that bats called within 500 milliseconds of a conspecific significantly more
than expected based on a random calling model. I found significant individual variation in call structure, and showed that bats perceive these differences in call structure. These findings are the first evidence of both antiphonal calling and individual vocal discrimination among adult bats. I suggest that *D. youngi* use antiphonal contact calls to mediate social interactions among individuals outside the roost.

4 PHYLOGENETICS AND BIOGEOGRAPHY OF THE BROAD-NOSED BATS, GENUS *PLATYRRHINUS* (CHIROPTERA: PHYLLOSTOMIDAE)

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The Neotropical broad-nosed bats, genus *Platyrrhinus*, represent a well-defined monophyletic group of 14 recognized species. A recent study of morphological characters confirmed *Platyrrhinus monophyly*, but offered little support to their intra-specific relationships. I conducted phylogenetic analyses of the genus, using dense taxonomic sampling in combination with 5 gene sequences representing both mitochondrial and nuclear DNA transmission systems. My aim was to elucidate the phylogenetic structure among species, using the resulting 4412 bp of DNA. Maximum parsimony, maximum likelihood, and Bayesian inference analyses produced similar topologies that confirm the monophyly of the genus *Platyrrhinus* and strongly support many previously unrecognized groups. Paraphyly of *P. helleri* and the unclear position of *P. brachycephalus* in the clades were also apparent in the data. *Platyrrhinus* phylogeny supports a hypothesis of area relationships involving a basal divergence of Atlantic Forest bats, followed by subsequent radiations of lineages in the Andes and lowland forests. *Platyrrhinus* inhabiting the Guianan Shield and the Pacific lowlands and Central America apparently resulted from secondary dispersal from Amazonian and Andean centers, respectively.

5 THERMAL BENEFITS OF CLUSTERING DURING HIBERNATION: A FIELD TEST OF COMPETING HYPOTHESES ON *MYOTIS SODALIS*

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Clustering lessens heat loss in euthermic animals by decreasing exposed surface area. However, clustering is also used by mammals during heterothermic periods such as hibernation, when heat loss should be minimal because body temperature (T<sub>b</sub>) is near ambient temperature (T<sub>a</sub>). I tested two hypotheses that attempt to explain the thermal benefit of clustering to cave-dwelling bats during hibernation: (1) clustering buffers individuals against fluctuations in T<sub>a</sub> ("thermal inertia hypothesis"), and (2) clustering minimizes heat loss during energetically expensive arousals and subsequent periods of euthermy ("arousal hypothesis"). These hypotheses are competing, but not mutually exclusive, and benefits may be realized during both heterothermic and euthermic periods. I created path models for each hypothesis and parameterized them with data obtained from thermal and digital images of naturally hibernating *Myotis sodalis* clusters and temperature-sensitive data loggers placed near each cluster. Akaike weights (ω<sub>i</sub>) indicate the arousal hypothesis has nearly complete support (ω<sub>i</sub> = 0.9999), while the thermal inertia hypothesis has little support (ω<sub>i</sub> = 0.0001). As predicted by the arousal hypothesis, mean T<sub>a</sub> is the strongest predictor of cluster size. Further, after accounting for mean T<sub>a</sub>, cluster size is negatively related to variation in T<sub>a</sub>. My results indicate that most of the thermal benefit of clustering during hibernation is from decreased heat loss during brief euthermic periods. In addition, my results lead to predictions that (1) in stable environments, clustering may lessen mass lost during the season of hibernation, (2) clustering may be minimized during hibernation when there are large fluctuations in the thermal environment. Further, our results predict that clustering 1) may lessen mass loss during hibernation in stable environments, 2) may be minimized during hibernation when there are large fluctuations in the thermal environment, and 3) that the propensity to cluster may be negatively related to body condition.
6 THE NATURAL HISTORY CONUNDRUM REVISITED: MAMMALOLOGY BEGINS AT HOME

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Much has been written by previous recipients of the Joseph Grinnell Award about the declining interest in natural history and organismic biology in academia and in society in general. In the course of 40 years of university teaching and student advising, as well as field research with students on five continents, I too have witnessed this increasing abandonment of the natural world. This phenomenon – this malaise – seems to stem from much more than curricular changes, academic personalities or scientific trendiness. Let me offer a few perceptions of this situation starting from the premise that “mammalogy begins at home.” Three types of learning seem important to the developing mind. First is the time and opportunity for unstructured, unforced exploration of the natural world – time to observe, to question, to play, to wonder – to develop from the inside out rather than as a shell coated with an infinite number of intellectual veneers. Second is learning from the example and caring instruction of enthusiastic parents, teachers, mentors and peers. Third is the transfer of information – from personal experience, reading, teaching and a vast array of electronic sources – once again with time for synthesis and contemplation. All three types of learning appear to be critical to an appreciation of the natural world. Unfortunately, these processes have been grossly distorted by the loss of outdoor experience, by parental fears, controls and misguided ambitions, and by a kind of electronic idolatry associated with instant gratification, constant diversion, and virtual relationships. Not only is a child’s education affected, but apparently its mental and physical health as well. And, such an upbringing also appears to suppress future commitment to preserving the natural world as an adult. Published studies of “nature deficit disorder”, “videophilia” and “ecophobia” now describe this phenomenon. Fortunately, there seems to be a reaction to two generations of such misdirected education, and organizations like the ASM have a role to play in this change.

7 YOUR JOURNAL

Ed Heske, Jenny Duggan, and Joe Merritt, Illinois Natural History Survey

Have you wondered what happens behind the pages of Allen Track? Come and get some new insights into what goes on in the Journal of Mammalogy Home Office. What happens to your precious manuscript after you click “submit?” We will review some patterns and trends in annual number of submissions, acceptance rate, and manuscript processing times. Learn a few things you can do to make the process go more quickly. How international is JM? From where are most articles submitted (hint, less than half now come from the U. S.!)? Do you know what the “buddy system” is? How diverse is our taxonomic coverage? Do systematics papers fare better than ecological ones? What are some of the new directions JM might take, such as electronic publication before print? We’ll also leave some time for your suggestions for improving JM.

8 MAMMALIAN SPECIES: MONOGRAPHS WITH IMPACT

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Mammalian Species has undergone various changes in style and format since the 1st account was published in 1968, and beginning in 2007, editors responsible for this monographic series initiated substantial changes designed to enhance impact, author and reader appeal, and participation. Focused changes include: online submission; front page inclusion of author names and bylines, abstract, key words, and hyperlinks to the ASM Home Page, all designed to enhance indexing and identification in
the digital world; options to present a simplified synonymy and original skeletal measurements; and inclusion of more color figures, audio, and video. The high impact of *Mammalian Species* is already apparent when conducting Internet-based searches; accounts consistently appear on the 1st page of searches of scientific or common names of mammals. We believe that this “new day” for *Mammalian Species* will further enhance ASM’s dissemination of information and benefit our understanding of mammals globally.

9 SPECIATION AT THE CREST OF THE MAMMALIAN CROWN: AUSTRALIAN AND NEW GUINEA *RATTUS*

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Recent radiations, coupled with biogeographic expansions, are associated with a large percent of extant Mammalian diversity, particularly in rodents. With over 60 species currently recognized, *Rattus* is the most diverse genus of mammals, but they are also one of the youngest. They are members of the most diverse mammalian subfamily, Murinae, that first appeared in the fossil record 10-15 Mya. While *Rattus* first evolved in southeast Asia, nearly one-third of the species are known from Australia and New Guinea which they colonized less than 1-2 Mya. We present the first character-based phylogeny of the New Guinea and Australian *Rattus*. We estimated phylogenies from >900 nucleotides of mtDNA and >9500 nucleotides from eight autosomal nuclear loci using a partitioned Bayesian analysis. We examined diversification in relation to adaptation to open habitats and the significance of chromosomal rearrangements in driving speciation in the group. Our results supported a monophyletic New Guinea (*leucopus*) group and a monophyletic Australian (*fuscipes*) group. In each case a single species (*Rattus leucopus* and *Rattus fuscipes*, respectively) was recovered as older than all other species combined indicating that they were ancestral to all other species. In addition, we examined the biogeography and historical demography of these two ancestral species in relation to their expansions across Australia and their syntopic interactions in northeastern Australia.

10 WHAT IS *PEROMYSCUS*? A PHYLOGENY BASED ON MULTIPLE DATA SETS

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Being one of the most widely studied rodent genera in the world surprisingly little is know about the phylogenetic relationships of the genus *Peromyscus*. Recently, the monophyly of *Peromyscus* has been challenged based on a mitochondrial, cytochrome-b (Cytb) phylogeny (Bradley et al. 2007). According to Bradley et al. (2007), many recognized genera fall within a *Peromyscus* clade resulting in a paraphyletic assemblage. To test the paraphyletic relationships of *Peromyscus*, sequence data from the nuclear, intron 2 of the alcohol dehydrogenase gene (Adh1-I2) of species belonging to *Peromyscus*, *Habromys*, *Isthmomys*, *Megadontomys*, *Osgoodomys* and *Podomys* were used to build a molecular phylogeny of *Peromyscus*. Adh1-I2 sequences were analyzed independently and concatenated with the Cytb sequences to try providing greater resolution at basal nodes to test the hypothesis of Bradley et al. (2007). Analyses of both Adh1-I2 and the combined data sets including, maximum parsimony, maximum likelihood, and Bayesian analysis provide evidence for a paraphyletic assemblage with *Habromys*, *Megadontomys*, *Podomys*, and *Osgoodomys* falling within *Peromyscus*, suggesting that a taxonomic revision of the genus *Peromyscus* is necessary.
11 CHROMOSOME PAINTING IN SIGMODON: A TEST OF PARSIMONY AND ALTERNATIVE PHYLOGENETIC HYPOTHESES

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In 1970, Zimmerman produced a phylogeny that explained chromosomal evolution in the genus *Sigmodon*. More recently, Dallas Henson (TTU) produced a phylogenetic tree based on three genes (cytochrome b, IRBP, and beta fibrinogen). These two trees have different implications for chromosomal evolution. The chromosomal tree uses parsimony to minimize the required number of rearrangements whereas the gene tree would likely double the required rearrangements to explain chromosomal evolution if the ancestral karyotype is like that of *S. hispidus*. In this study, we use a series of chromosome paints made from *S. hispidus* to determine if results of phylogenetic placement of shared chromosomal rearrangements is capable of resolving this conflict. If the karyotype of *S. hispidus* is primitive, chromosome paint results indicate that the number of rearrangements required to explain chromosomal evolution is not parsimonious with shared similar diploid and fundamental numbers. Here, we focus on the species within *Sigmodon* with a future goal of hybridizing paints that are conserved among the species of *Sigmodon* to South American Sigmodontine species. Of the 22 chromosomal paints isolated from *S. hispidus*, chromosome X and 1 are conserved through most species of *Sigmodon*. An exception is *S. fulviventer*, where chromosome 1 of *S. hispidus* hybridizes to chromosome 2 of *S. fulviventer*. Painted chromosomes of *S. arizonae* and *S. fulviventer* are compared to pseudo-G bands of *S. hispidus*, *S. arizonae*, and *S. fulviventer* to further visualize homologous regions between these three species.

12 GENETICS OF HYBRIDIZATION IN TREE SQUIRRELS (GENUS TAMIASCIURUS) FROM A CONTACT ZONE IN THE PACIFIC NORTHWEST

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Several pairs of closely related mammalian taxa meet in secondary contact zones in or near the Cascade Mountains in the Pacific Northwest. Whether hybridization is occurring is not well understood. The genus *Tamiasciurus* contains two parapatric tree squirrels (*T. douglasii* and *hudsonicus*) that meet in the Pacific Northwest. Some of the squirrels in areas of contact possess intermediate forms of ventral pelage color and vocalization, suggesting hybridization. We have begun an examination of this problem using molecular techniques on 300 museum specimens across an approximate 500-km east-west transect that includes a narrow contact zone in the northern Cascades. First, we describe diagnostic haplotypes for each species based on a 275-base-pair sequence of the mitochondrial DNA (mtDNA) control region. Next, we present evidence that hybridization is likely occurring within the contact zone since several individuals with apparent pelage coloration indicative of one species possessed the mtDNA haplotype of the other. Furthermore, putative hybrids with intermediate coloration segregated into either *T. douglasii* or *hudsonicus* haplotype groups. This evidence represents the first step in determining whether hybridization has resulted from the secondary contact of closely related taxa.

13 GENETIC VARIATION AND PHYLOGEOGRAPHY OF RATTUS RATTUS AND R. NORVEGICUS

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Rattus norvegicus and R. rattus are two of the most costly invasive species in the United States, costing billions of dollars each year in damages and preventative measures. They are capable of spreading disease, spoiling food supplies and causing significant structural damage. While it is clear that these species of Rattus have a significant impact on the United States in terms of ecologic, economic, and epidemiologic characteristics, few studies have focused on the genetic structure or phylogeography of populations of R. rattus, R. norvegicus, or their close congeners (e.g. R. tanezumi, R. exulans) if these are surreptitiously invading the U.S. We obtained tissue samples of more than 150 Rattus throughout the U.S. and sequenced the entire cytochrome b gene for each individual. Phylogenetic relationships were estimated based on maximum-likelihood and unweighted parsimony, and to determine stability of clades we performed bootstrap analysis. Finally, we estimated phylogenetic relationships using Bayesian methods. The primary purpose of these analyses was to aid in taxonomic identification due to the difficulty of identifying species of Rattus based on morphological characteristics alone. ARLEQUIN was used to determine intrapopulational mitochondrial cytochrome b haplotype (h) and nucleotide (π) diversity, as well as the level of sequence differentiation between defined groups (ΦST). TCS was used to generate an unrooted haplotype network and historical demography was inferred using h, π, and mismatch distribution of pairwise nucleotide difference.

14 MOLECULAR SYSTEMATICS AND BIOGEOGRAPHY OF MESOAMERICAN FLYING SQUIRRELS

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Populations of flying squirrels occupying the oak and oak-pine forests of the Mesoamerican highlands represent the least studied and most poorly known members of the genus Glaucomys. Traditionally, these Mesoamerican populations have been considered to be southern disjuncts of the southern flying squirrel, G. volans, a species that is also widespread across the deciduous and mixed-deciduous forests of eastern North America. However, the small number of existing museum specimens (less than 65) of Mesoamerican flying squirrels has made discerning the systematic and biogeographic relationships of these populations challenging. In an effort to clarify the systematic position and biogeographic history of the Mesoamerican flying squirrels, we used ancient DNA techniques to extract, amplify, and sequence a 571-bp segment of the mtDNA cytochrome b gene from 34 of museum specimens. These represented each of six recognized subspecies of Mesoamerican flying squirrels. We combined these data with homologous sequences from representative populations of Glaucomys from across the rest of North America and analyzed the full dataset phylogenetically (using parsimony, likelihood and Bayesian approaches). Our results indicate that Mesoamerican flying squirrels form monophyletic group that is sister to populations of G. volans from eastern North America. Within Mesoamerica, there are two distinct mtDNA lineages of flying squirrels: one comprised of populations from the Sierra Madre Oriental, Oaxacan highlands and Sierra Madre de Chiapas, and one comprised of populations from the Sierra Madre del Sur. These phylogenetic relationships suggest that divergence of Mesoamerican populations from those in eastern North America preceded a series of subsequent divergence events within Mesoamerica.

15 MOLECULAR CHARACTERIZATION OF CLASS II MHC LOCI IN THE BANNER-TAILED KANGAROO RAT (DIPODOMYS SPECTABILIS)

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Genes of the major histocompatibility complex (MHC) are exceptionally polymorphic due to the combined effects of natural and sexual selection. Most research in wild populations has focused on the second exon of a single class II locus (DRB), but complete gene sequences can provide an illuminating backdrop for studies of intragenic selection, recombination, and organization. To this end, we isolated multiple class II loci from spleen cDNA of the banner-tailed kangaroo rat (Dipodomys spectabilis). Seven class II loci (provisionally named MhcDisp-DRB*01 through -DRB*07) were isolated using a hybridization-enrichment procedure and PCR measures. In silico translation revealed the presence of important structural residues for glycosylation sites, salt bonds, and CD4+ T-cell recognition. Amino acid distances varied widely among the seven sequences (2-34%). Two of the transcripts (DRB*03 and DRB*07) were missing exon 5 (cytoplasmic tail domain), indicating they may be pseudogenes or previously uncharacterized class II loci with an undescribed function. Nuclear DNA sequences (~10kb) from the Disp-DRB*07 locus revealed a conventional exon/intron structure as well as a number of microsatellites and SINE elements (Alu and members of the IDL-Geo SINE subfamily). Rates of nucleotide substitution at Disp-DRB*07 are similar in both exons and introns (π = 0.009 and 0.011, respectively), which suggests relaxed selection on this locus. Finally, we performed BLASTn searches against D. ordii genomic sequences (unassembled reads) and find 90-97% similarity in class II genes between the two kangaroo rat species. These are the first class II MHC loci to be characterized in the Heteromyidae and will serve as the basis for future genetic studies of natural and sexual selection in this ecologically important group.

16 HOME ON THE PRAIRIE: A STUDY OF AMERICAN MARTEN (MARTES AMERICANA) DISTRIBUTION AND HABITAT FRAGMENTATION

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The North Dakotan Turtle Mountains are an island of forested habitat home to the American marten, a meso-carnivore in the mustelid family. The American marten population disappeared around 1940 from this region, but recently reappeared; however, both their distribution and the effects of habitat fragmentation on their distribution are unknown. Historically, American martens have been documented in the Turtle Mountains; yet current descriptions of favorable marten habitat do not match any North Dakotan habitats. We used track plates and trap cameras to determine the presence/absence of the marten and determined that American martens were present. These data were used in conjunction with the following landscape metrics to model marten presence at multiple scales: number of forest patches, mean patch size, edge density, amount of water, amount of forest, stream density, road density, and the interspersion juxtaposition index (IJI). This isolated landscape allowed us to investigate the effects of forest fragmentation on marten distribution and ultimately verify American marten range expansion. This research will allow local and state policy makers to make informed decisions about the management of areas vital to the survival of this meso-carnivore.

17 POTENTIAL PLEISTOCENE DISTRIBUTIONS AND ASSOCIATIONS OF NORTH AMERICAN SMALL MAMMALS

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The concept of the conservation of the ecological niche (EN) has been applied to a variety of taxa to examine potential patterns of distribution. I examined the projected EN of a multitude of small mammals from North America to examine potential community structures. I generated EN projections from current occurrence data and seven environmental variables using GARP and Maxent. The EN models were projected onto two
Pleistocene climate scenarios, and patterns were analyzed for faunal associations. Beyond potential communities, I also generated EN models for nearly all members of two genera, Tamias and Neotoma, to examine how similarity within evolutionary lineages may impact the evaluation of potential distributions. For instance, apparent novel species’ associations may be more likely if one species is currently associated with the another’s sister species.

18 THE LATE QUATERNARY MAMMALIAN RECORD AND CLIMATE CHANGE IN COASTAL SOUTHEAST ALASKA

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The mammalian fossil record from On Your Knees Cave and other caves of Southeast Alaska documents effects of drastic climate change in an island environment over the past 50,000 years. During the Middle Wisconsin Interstadial the fauna was dominated by black and brown bear, Arctic fox, river otter, caribou, hoary marmot, heather vole, long-tailed vole, and brown lemming. A transition at 24,000 KA is marked by the loss of bears and caribou and the appearance of ringed seal, indicating the presence of coastal sea ice. Progressive cooling and expanding glaciers during the Last Glacial Maximum eventually led to the extirpation of all rodents. A gap in the fossil record between 17,000 and 14,500 KA probably represents glacial overrun at the cave as suggested by local tills. Ringed seals remained until 13,700 KA. Brown bear, caribou, Arctic fox, and red fox were present from 12,000 KY until the early Holocene when they died out, probably in competition with the modern forest-adapted mammal fauna (black bear, gray wolf, and black-tailed deer). Black bear and river otter were prominent throughout the postglacial interval. Rodents were delayed in island recolonization, but forest-adapted long-tailed vole, Keen's mouse, and northern flying squirrel appeared sometime in the Holocene. Cold-adapted small mammals failed to recolonize Prince of Wales Island during the brief interval before forest development, and the islands still have low rodent and lagomorph diversity compared with the adjacent mainland. Relative abundance of rodent fossils varies considerably in cave sediments of different ages, providing a valuable climate proxy. Brown lemming and heather vole are most abundant during cold intervals while long-tailed vole and hoary marmot dominate warmer intervals. The cave faunas demonstrate that coastal Alaska was habitable to cold-adapted mammals during the Last Glacial Maximum, perhaps in local refugia, and that glaciation was much briefer than previously thought.

19 TESTING JANZEN’S HYPOTHESIS “WHY MOUNTAIN PASSES ARE HIGHER IN THE TROPICS” WITH VERTEBRATES

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In 1967, Dan Janzen proposed that tropical mountains would be "higher" or more effective montane barriers to dispersal based on latitudinal variation in climate and physiology. Specifically, he posited that the high seasonal overlap of thermal regimes at low and high elevations in the temperate zone leads to species with large thermal tolerances and thus large elevational distributions. In contrast, the low seasonal overlap in temperature between low and high elevations on tropical mountains leads to species with narrow thermal tolerances and thus small elevational distributions. His hypothesis has been highly influential in thinking about physiological ecology, speciation, range sizes, and the latitudinal diversity gradient. Most of the predictions of Janzen's model have yet to be directly tested. Here I examine whether elevational range sizes of vertebrates--rodents, bats, birds, lizards, snakes, salamanders, and frogs--get larger on mountains with increasing latitude. Analyses use multiple elevational gradients spanning 36.5° S to 48.2° N latitude: rodents (34 gradients), bats (12), birds (41), lizards (16), snakes (16), salamanders (24), and frogs (44). Increased fit to predictions are expected for ectotherms versus endotherms, low versus high vagility species, and low versus high elevation
species. Bats and salamanders were the only two groups to have strong significant increases in elevational range size with latitude, both in absolute size and size adjusted for mountain height. When including only mountains over 2000m of inhabited height, all ectotherms followed Janzen's predictions, but rodents and birds did not. Overall, bats, ectotherms, and low elevation species did increase range size with increasing latitude, but vagility did not appear to be an important distinction among groups of vertebrates.

20 ELEVATIONAL PATTERNS OF MAMMALS AND BIRDS OF MANU, AS REVISED BY EXPANDED SAMPLING

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Tropical systems on the eastern slopes of the Andes may be the most diverse ecosystems on earth. We recently completed a three-year inventory of mammals and birds along an elevational gradient from 450-3450m in Manu Biosphere Reserve in southeastern Peru. Our report listed 222 species of mammals (12 of them new) and 1005 species of birds, up from 193 and 901 species, respectively, a decade earlier. The reserve continues as to be the world's richest protected area for both vertebrate groups. We show how recent discoveries have altered several diversity patterns described previously for Andean vertebrates, presenting revised patterns of richness, range amplitude, range boundaries, and nestedness for these faunas. Of note, the quadratic (inverse-hump) relationship between between species richness and elevation is maintained but attenuated in the expanded data set. The relationships of these patterns to ecological and historical explanations are discussed.

21 COMPARING CURRENT TO HISTORIC SOUTHERN DISTRIBUTION OF OCHROTOMYS NUTTALLI IN FLORIDA.

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The golden mouse (Ochrotomys nuttalli) is a semi-arboreal small mammal species that occurs throughout the southeastern deciduous hardwood and pine forests. Although this species occupies a relatively wide geographic range, it is not commonly captured in live traps. This project examines the current status of the golden mouse in the state of Florida through presence/absence and relative abundance estimates. Historical collection locales accumulated from the literature, museum specimens, and personal communication were mapped along with habitat variables using GIS. Regions where collection records differed from both the published range map and favorable habitats available were identified in the southwest portion of the state. Trapping conducted in this region revealed no additional southerly golden mouse locales. Changes in the current from historic distribution were assessed by trapping near the southernmost documented locations on each of the three main southern ridges of the state: the Polk uplands, Lake Wales Ridge, and Atlantic Coastal Ridge. The persistence of southerly golden mice populations has thus far been confirmed on the Polk uplands and Lake Wales Ridge, where suitable habitat remains. Golden mice had low capture rates even in favorable habitat when compared to other small mammal species. Although trapping data indicate that the geographic range of the golden mouse has changed little from historic records on the west and central ridges, further research is needed to assess the effects of increasing landscape-level habitat fragmentation on the density, population structure, and genetics of this species.
Cottontail rabbits of the genus *Sylvilagus* are distributed from North America to northern Argentina and from 0 to 5000 meters in elevation. Most of the currently recognized 18 species are Nearctic in distribution, but it is difficult to ascertain if the apparent imbalance in the distribution of species diversity is real or an artifact of poor understanding of species limits in the Neotropical forms. The last revision of South American cottontails, published over 50 years ago, resulted in several incongruous hypotheses of specific limits and geographic distribution; for example, the Tapeti (*Sylvilagus brasiliensis*) is thought to range from Southern Mexico to Northern Argentina, in all habitats from sea level to Andean Páramo. In this talk, we present results of the phylogenetic relationships of nominal forms of *Sylvilagus* based on analysis of sequence data. Our results indicate a substantial disconnect between current taxonomy and the phylogenetic relationships revealed by our analyses of the sequence data. Sequence divergence in the 12rRNA of the mtDNA gene ranges from 3-8%, orders of magnitude higher that those found among species of *Sylvilagus* recognized in North America (as little as 0.8% in the same gene). The biogeography of the genus remains complex. We hypothesize that *Sylvilagus* originated primarily as a dry forest and xeric adapted genus, with the first excursion from this pattern being the Southeast North American sister taxa *S. aquaticus* and *S. palustris*. By and large, remaining cladogenic events are localized to xeric areas of the southwest: the Californian *S. bachmani*, the desert SW *audubonii* and montane endemics of New Mexico. A major cladogenic event is the split between North and South American groups. Far from being a single species, we resolve minimally among *andinus*, *defilippi*, *dicei*.

23 ABANDONED MICROCRYSTALLINE SILICA MINES: LONG-TERM VIABILITY FOR USE BY HIBERNATING BATS

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About 12 species of bats occur in Illinois, most of which hibernate during the winter. Because of destruction of natural habitats, many bat species rely on abandoned mines for hibernacula. In southern Illinois, abandoned underground microcrystalline silica mines provide winter hibernacula for five species of bats: the federally endangered Indiana bat (*Myotis sodalis*), big brown bat (*Eptesicus fuscus*), little brown bat (*M. lucifugus*), northern long-eared bat (*M. septentrionalis*), and eastern pipistrelle (*Perimyotis subflavus*). Within the last decade, the number of Indiana bats using these large "room and pillar" mines as hibernacula has risen dramatically. For example, Magazine Mine now houses >45,000 hibernating Indiana bats. We conducted 110 surveys of 45 abandoned mines between 2003 and 2007 to determine predictive factors for the total number of bats as well as the number of each species using a mine. We found 75,067 bats hibernating in 43 mines. We measured the following habitat factors: size of the opening, number of openings, mean temperature during hibernation (November through March), temperature variability, distance to water, distance to nearest road, and evidence of disturbance. Additionally, we investigated the stability of selected mines. Specifically, we attempted to quantify the extent of spalling (exfoliation of material) from walls and ceilings and the potential impact spalling events could have on large clusters of hibernating Indiana bats.
24 ECOLOGICAL STUDY OF BATS IN THE TEXAS PANHANDLE

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Palo Duro Canyon is located along the edge of the Southern High Plains and the Rolling Plains in the Panhandle of Texas and contains a variety of habitat and roost sites for bats. Our objectives were to document the species of bats present, examine the timing of their activity, and document reproduction and roost sites. We sampled bats by mist netting and identified roosting bats during cave surveys. In 76 nights (224 net nights) from July-October 2006 and April 2007-February 2008, 12 species of bats were captured in mist nets. Five species were netted during the winter. Seven cave surveys of 8 caves and 1 man made structure documented 4 species of bats roosting in caves and 2 species roosting in the man made structure. No roosts containing more than 8 bats or any nonvolant young were found. Juveniles of 6 species and pregnant or lactating females of 5 species were observed in the canyon. Our research addresses the dearth of ecological data in our area on bats and provides a data set that can be used to anticipate or evaluate the future impact of large-scale wind-energy development.

25 SEASONAL VARIATION IN THE SIZE OF A COLONY OF FREE-TAILED BATS

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A colony of Brazilian free-tailed bats (Tadarida brasiliensis mexicana) was found to inhabit an abandoned railroad tunnel in Floyd County, Texas in 1992. The tunnel is part of Caprock Canyons State Park and is open to public use. Our objectives were to determine the size and the variation in the size of the colony over time. We began recording the emergence of bats approximately every other month, beginning in October 2006, using video cameras and infrared lights. The minimum number of bats using the tunnel was determined by counting the number of bats emerging from and returning to the tunnel using slow-motion playback of the video. The number of bats emerging from the tunnel varied over time. We counted 47,902 bats emerging from the tunnel in October 2006, 251 bats in February 2007, 128,662 bats in May 2007, 70,705 bats in June 2007, and 64,519 and 108,177 bats in July 2007. Though T. b. mexicana is migratory, individuals were present in the tunnel during all months of the year. Numerous threats to this colony exist including visitor disturbance and proposed large-scale wind-energy development on lands near the tunnel. Our research will provide base-line information on the colony allowing us to assess the impacts of these and other possible threats.

26 EFFECTS OF HABITAT CONVERSION ON TEMPORAL ACTIVITY PATTERNS OF PHYLLOSTOMID BATS IN AMAZONIA

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Habitat loss and fragmentation associated with human activities are among the most pervasive threats to species persistence and the conservation of biodiversity. Ecological assessments of the effects of anthropogenic change often focus on species richness or species abundances. Nonetheless, changes in behavior (e.g., activity patterns) may provide equally important insights into responses to disturbance that have conservation or management implications. We evaluated the effects of season and habitat conversion on temporal activity patterns of the 8 most abundant species of frugivorous bat in lowland tropical forest of Peru.
Season had little effect on activity of any bat species. Five species evinced different activity patterns in forest than in agricultural habitats. No interspecific differences in activity occurred in primary forest. All interspecific differences in activity in agricultural habitats or secondary forest involved Artibeus lituratus, Carollia benkeithi, or Rhinophylla pumilio. Temporal activity patterns of common frugivores overlapped more than expected by chance regardless of season or habitat. Neotropical frugivores may employ a "first-come-first-served" foraging strategy, but avoid open areas during twilight because of associated predation risks. Frugivores must consume large quantities of fruit each night. Consequently, potential negative effects of competition are trumped by the importance of obtaining sufficient caloric intake to meet minimum daily requirements. Because bats avoid open areas during twilight and periods of great lunar illumination, increased habitat fragmentation may reduce foraging times and subject bats to increased risk from predators. Despite the ability of many frugivorous species to exploit disturbed areas, landscapes dominated by open habitats may support fewer viable populations of bats than areas with large intact tracts of forest.

27 SCALE-DEPENDENT RESPONSES OF PHYLLOSTOMIDS TO LANDSCAPE STRUCTURE

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Habitat loss and fragmentation are increasing at an alarming rate in the tropics and represent serious threats to biodiversity. Nonetheless, little is known about the responses of tropical biotas to spatially explicit aspects of landscape structure that arise from anthropogenic activities. To address this, we examined the population- and assemblage-level responses of bats to landscape composition and configuration at three different focal scales in lowland Amazonia. Generally, responses to landscape characteristics were scale dependent. Abundances and richness of species were higher in moderately fragmented forest than in continuous forest. Moreover, abundances of nine species, all frugivores, decreased with increasing forest cover. Abundances of frugivores likely responded to landscape composition (e.g., percent forest, mean patch density) because of an increase in early successional fruits and flowers in areas with reduced canopy cover. In contrast, abundances of gleaning animalivores responded to landscape configuration (e.g., edge density, proximity), likely exploiting low contrast edges (i.e., closed canopy forest patches embedded in secondary forest) while foraging and traveling between higher quality patches. Species richness, evenness, and dominance responded only to landscape configuration (e.g., nearest neighbor distances, edge density). The ensemble-specific responses of species suggest that compositional and configurational characteristics of landscapes need to be considered in conservation or management plans.

28 THE LAST OF THE MOHICANS: FRUIT-EATING BATS AS THE LAST LARGE-SEED DISPERSERS IN DEFAUNATED FOREST FRAGMENTS

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The last of the Mohicans: fruit-eating bats as the last large seed dispersers in defaunated forest fragments. In tropical regions, fruit-bats are among the most important components of the frugivorous fauna remaining in disturbed landscapes. Yet, the role of bats as seed dispersers of large seeded plants is poorly documented. We investigated the seed shadows generated by small tent-roosting bats Artibeus watsoni in the Sarapiqui Basin, Costa Rica. We estimated the total number of seeds and seed species larger than 8 mm that bats disperse under their roost sites, compared the density and species composition of seed dispersed by tent-roosting bats with
seeds sampled away from the influence of tents, and compared bat-generated seed shadows in intact vs. fragmented forests. In all forests examined, leaf-tenting bats increased both seed and species density below tents by up to 10 times with the levels in control quadrats. Mean seed density beneath tents was reduced in small forest fragments compared to large, intact forest reserves. We observed a total of 43 seed species >8 mm but non-parametric estimators suggest up to 65 species may actually be present in the study areas. Our study demonstrates that the role of fruit-bats in dispersal of large seeded plants is far greater than previously known. Assuming that bats may persist in relatively large numbers in human-disturbed landscapes, we expect that at least a small flux of large seeds will be maintained in the absence of the medium-to large frugivores extirpated from forest fragments and over-hunted sites.

29 ROOST-SITE SELECTION OF EVENING BATS (NYCTICEIUS HUMERALIS) AT THE NORTHERN PERIPHERY OF THEIR RANGE

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Roosts provide bats with protection from environmental conditions and predators, and a site for pup-rearing, hibernation/torpor, and social interaction; therefore, species and individuals may differ in their selection of roosts based upon physiological or behavioral requirements. Bats may switch to a more suitable roost or exhibit intra- and inter-annual roost fidelity as physiological and environmental conditions change. We conducted a two-year study investigating roost switching and roost selection of the evening bat (Nycticeius humeralis) at the periphery of its range. In Michigan, only a single colony of evening bats is known, and it is the northernmost colony on the continent. During the two-year study, we captured 75 evening bats and radiotracked 46. We confirmed 33 roosts during the study, 15 of which were used in both years. Evening bats used cavities as roosting structures in 52% of confirmed trees and 67% of individuals preferred roosting in cavities; other types of roosts included exfoliating bark and crevices. Although evening bats exhibited roost fidelity, they switched trees every 2.8 days. Studying the roosting ecology of evening bats in Michigan provides insight as to how a southern species copes with life in a fragmented landscape at the northern edge of its range.

30 MULTIPLE CAPTURES OF WHITE-FOOTED MICE (PEROMYSCUS LEUCOPUS)

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Multiple captures (34 double, 6 triple) in standard Sherman live traps accounted for 6.3% of 1355 captures of Peromyscus leucopus (white-footed mice) in forested habitat in southern Illinois, from October 2004 through October 2005. There was a significant positive relationship between both the number and the proportion of multiple captures and estimated monthly population size. Multiple captures were all intraspecific and occurred significantly more often from November through March when animals were not reproductively active, but this was confounded by seasonal changes in abundance. Age/gender distribution of animals in double captures did not differ from that expected from random pairing. We suggest that sociality and synchronous entry of two white-footed mice into traps were the primary determinants of double captures; sensitivity of traps may have been the primary factor in triple captures.

31 SMALL MAMMALS FROM THE CHELEMHA CLOUD FOREST RESERVE, ALTA VERAPAZ, GUATEMALA

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The abundance and fine-scale distributions of mammals in the highlands of Guatemala remain poorly known. As part of a long-term effort to better determine the communities of small mammals inhabiting highland habitats in this region, we surveyed the remnant mixed hardwood/coniferous cloud forest at elevations ranging from 2100 m to 2300 m in the Chelemhá Cloud Forest Reserve, Alta Verapaz, Guatemala. Chelemhá is located in the Sierra Yalijux, an isolated mountain range between the towns of Cobán to the northwest and Tucurú to the southwest. Removal trapping using a combination of live traps, snap traps, and pit fall traps for 6 days in January 2007 resulted in 179 captures representing 15 species of shrews, rodents, and marsupials. This diversity of small mammals is the highest that we have recorded from a single locality in the highlands of Guatemala in five field seasons of work in the region. Based on capture rates, the most abundant species in the small mammal community are *Peromyscus grandis* (n = 51), *Handleyomys saturatior* (n = 29), *Heteromys desmarestianus* (n = 18), *Reithrodontomys mexicanus* (n = 17), *Oligoryzomys fulvescens* (n = 15), and *Sorex veraepacis* (n = 15), and *Scotinomys teguina* (n = 13). The remaining eight species were represented by from one to five individuals.

### 32 DISTRIBUTION OF EASTERN FOX SQUIRREL (*SCIURUS NIGER*) LEAF NESTS WITHIN A SUBURBAN/URBAN LANDSCAPE

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The objective of my study was to determine the influence of woodlot characteristics on Eastern fox squirrel (*Sciurus niger*) abundance and distribution within a suburban/urban landscape. I documented the density and placement of fox squirrel leaf nests in 20 woodlots in the Indianapolis metropolitan area, Marion County, Indiana as an indicator of fox squirrel abundance and distribution. The woodlots varied in size (0.94 to 19.5 ha), approximate age, shape, and degree of isolation from other woodlots and suitable squirrel habitat in the surrounding area. Active nests were randomly distributed in all but one woodlot where they were uniformly dispersed, and nests were not found in greater densities along the woodlot edge, contrary to previous reports. Only 8% of the nests observed were located in a tree with another nest. Nest density was not significantly related to woodlot size, approximate age, shape, or degree of woodlot isolation. Nest densities tended to be negatively correlated to woodlot size but not significantly so. My results suggest that the distribution patterns of fox squirrels are unaffected by habitat fragmentation across suburban/urban landscapes and that the patterns are similar to those within landscapes fragmented by agriculture.

### 33 BODY SIZE FREQUENCY DISTRIBUTIONS IN AFRICAN MAMMALS ARE BIMODAL AT ALL SPATIAL SCALES.

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We allocated terrestrial African mammals to major biomes, and regional and local assemblages were extracted from published and unpublished literature. We produced body size frequency distributions for local, regional,
biomic, and continental distributions, both for whole assemblages and for three foraging strata, and compared these using several standard metrics (e.g., mean and median size, interquartile range, skew, etc.). Differences between distributions were quantified using t-tests and analysis of variance. African mammal faunas exhibit features in common with those of North and South America, most notably the gradual reduction in the modality and skew of body size distributions with decreasing spatial scale. Unlike other continents, however, the African mammal fauna exhibits bimodal frequency distributions at all spatial scales. Our data suggest a role for competitive interactions in local assembly, as documented elsewhere, but further data on locally interacting assemblages are needed. The presence of a secondary mode at large body size may reflect coevolutionary adjustments to protohuman hunters and consequent escape from anthropogenic Pleistocene extinctions, but limited species richness at intermediate body sizes (ca. 250-4,000 g) remains anomalous and is not readily explained by either historical or contemporary (ecologic) factors. For the African mammal fauna, a key question in understanding the role of history vs. ecology may not be why there are so many large species, but why there are so few intermediate-sized species.

34 TICK BURDENS OF PEROMYSCUS LEUCOPUS AND INFECTION RATES BY BORRELIA IN FRAGMENTED VIRGINIA LANDSCAPE

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The recent emergence of southern tick-associated rash illness (STARI) has complicated the diagnosis of tick-borne disease in humans. The spirochetes Borrelia lonestari and B. burgdorferi cause the symptomatically indistinguishable STARI and Lyme disease. These bacteria are transmitted by the ixodid lonestar tick, Amblyomma americanum, and black-legged tick, Ixodes scapularis, that parasitize the white-footed deermouse, Peromyscus leucopus. Forest patch size can affect mouse density and may be a predictor of disease risk to humans. In Fredericksburg and Spotsylvania County National Military Park in Virginia we 1) determined ixodid tick burdens of mice and minimum infection rates (MIRs) of ticks by Borrelia spp., and 2) tested the ability of I. scapularis and the American dog tick, Dermacentor variabilis, to acquire B. lonestari. Tick and bacterial DNA from ticks on mice and forest substrate was amplified, sequenced, and identified to species. Mouse densities were greater (P < 0.05) in small (< 3-ha) forest patches, but tick burdens (number of ticks/mouse) were not related to mouse density (P > 0.05). No relationship (P > 0.05) was found between mouse and tick densities. B. burgdorferi was not detected in any ticks. B. lonestari was detected only in A. americanum nymphs and adults where MIRs were 3.4% (8 of 237) and 5.9% (1 of 17), respectively. Whether forest fragmentation affects local tick burdens and MIRs in the southern U.S. remains unknown. However, the absence of B. burgdorferi and presence of B. lonestari in A. americanum in our study support the hypothesis that many (most?) reported cases of Lyme disease in the South are actually STARI.

35 LISTENING IN THE DARK: THE MORPHOLOGY OF FLYING SQUIRREL BULLAE

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The flying squirrels (Tribe Pteromyini) exhibit a diversity in the auditory bullae unseen in any other group of squirrels. The diversity might be attributable to the increased importance of hearing or the increased difficulty of navigating in a nocturnal environment. Several flying squirrels (Glaucomyys, Eoglaucomys, Petaurista) have bullae that are very similar to those of tree squirrels (Sciurus). These three genera are believed to be basal members of the subtribal clades Glaucomyina and Pteromyina, and the morphology of their bullae is
probably primitive for the flying squirrel clade. Both of these subtribes also include species with derived bulla morphology. The number of septa are greatly increased in species of *Petinomys* (Glaucomyina) and in species of *Pteromyscus, Belomys,* and *Trogopterus* (Pteromyina). Also in some but not all species of *Hylotis* and *Iomys* (Glaucomyina), an inflated mastoid region is associated with bulla. With the assistance of digital x-rays we are able to compare the morphology within the bullae including the middle and inner ear as well as the three semicircular canals. We are utilizing the digital x-rays to study the details of the anatomy in the hopes of eventually understanding the function of the derived features.

36 MITOCHONDRIAL DNA VARIATION IN THE EASTERN GRAY SQUIRREL (*SCIURUS CAROLINENSIS*).


We assessed mitochondrial DNA (mtDNA) variation within and among populations of eastern gray squirrels using a 486 bp segment of the mtDNA control region. Our study included 84 individuals from 15 localities in the following states: Louisiana (6 localities), Mississippi (1), Tennessee (1), Indiana (1), Alabama (1), Georgia (1), Virginia (2), and Maryland (2). We detected 65 haplotypes, 64 of which occurred at only one locality. Phylogenetic analysis revealed two major clades but no strong phylogeographic pattern. One clade is characterized by short terminal branches and weak bootstrap support of sub-clades, indicating relatively rapid and relatively recent differentiation of these haplotypes, which are distributed over the eastern two-thirds of the area that was sampled. The other clade includes haplotypes from each of the fifteen localities we sampled and is characterized by longer terminal branches and multiple sub-clades that have strong bootstrap support. The genetic structure exhibited in these squirrels is not related to geographic origin or to taxonomic assignment of individuals. Mismatch distribution analyses indicate that haplotype frequencies provide evidence for rapid demographic change. These results may reflect multiple episodes of range expansion and contraction from glacial refugia. We also consider the possibility that these results may be due to anthropogenic movement of animals.

37 A REVIEW OF CETACEAN AND PINNIPED STRANDINGS IN GEORGIA, USA:1977-2007

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Examination of stranded marine mammals has long provided opportunities to learn about the life histories of these unique animals and, more recently, to document the effects of human activities (e.g. fishery interactions, boat/ship strikes, anthropogenic chemicals, trash) on them. Strandings have long been of interest to biologists, but it was not until late in 1977 that a coordinated stranding network was instituted under the authority of the U. S. National Marine Fisheries Service and the Marine Mammal Protection Act of 1972. Since 1977, the primarily volunteer stranding network in Georgia has recorded 18 species of cetaceans and one species of pinniped (harbor seal, *Phoca vitulina*) and included five new state records. From 1977 through 2007, 684 strandings were reported ranging from 1-47 per year (mean = 21.7/yr). The bottlenose dolphin (*Tursiops truncatus*) was the most commonly reported species (total = 426 animals in 419 events) ranging from 0-29 animals/year (mean = 13.7 animals/yr). The pygmy sperm whale (*Kogia breviceps*) was next with 102 animals
in 78 events (0-10 animals/yr, mean=3.3 animals/yr.). Mass strandings (>2 animals) were recorded for three species: pygmy killer whale (*Feresa attenuata*), rough-toothed dolphin (*Steno bredanensis*) and short-finned pilot whale (*Globicephala macrorhynchus*). Camden County had the most strandings (n=255; 37.3% of strandings; 21.1% of GA coastline); Chatham County (n=156; 23.9% and 22.8%, respectively); Glynn County (n=142; 25.2% and 20.8%, respectively); McIntosh County (n=77; 17.6% and 11.3%, respectively); Liberty County (n=39; 12.0% and 5.7%, respectively); Bryan County (n=4), and Long County (n=1). Strandings were reported most frequently in March and April (particularly *Tursiops*) with minima in September, October and November.

38 MULTI-SPECIES OCCUPANCY AND DETECTION OF SYMPATRIC MESOCARNIVORES IN SOUTHERN ILLINOIS

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Coyotes (*Canis latrans*), bobcats (*Lynx rufus*), gray foxes (*Urocyon cinereoargenteus*), and red foxes (*Vulpes vulpes*) are ecologically and economically important mesocarnivores that occur sympatrically throughout much of their ranges. Although much is known about the habitat associations for these species individually, few studies have assessed habitat covariates that affect multi-species occupancy and detection of mesocarnivores at large scales. We estimated species-specific detection (*ρ*) and occupancy (*ψ*) of sympatric mesocarnivores in the 16 southernmost counties of Illinois. During January-April 2008, we used remote-sensing cameras and hair snare to survey for mesocarnivores at 464 sites in 116 2.6-km² sections stratified by the proportion of forest cover. In addition, we characterized microhabitat (e.g., stem density, vertical cover) and macrohabitat (e.g., percent forest cover, mean patch size of grassland cover) at each site. Encounter histories were used to estimate habitat influences on *ψ* and *ρ* using multi-species models in program PRESENCE 2.0. Coyotes had the highest occupancy estimates (0.79); followed by bobcat (0.45), gray fox (0.18), and red fox (0.08). Our results indicate that presence of bobcats and gray foxes were positively related to percentage of forest cover. Gray foxes were less likely to occupy sites with coyotes present, which suggests that intraguild predation or resource competition may alter the distribution of gray foxes. Our study provides insight into habitat features that may influence the spatial and temporal detectability of mesocarnivores in the Midwest.

39 DISPERAL IN A SOCIAL CARNIVORE (*NASUA NARICA*): TROPICAL VERSUS TEMPERATE TRENDS

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Natal dispersal in mammals is generally sex-biased, with males leaving natal ranges prior to sexual maturity and females remaining philopatric. Several hypotheses have been proposed to explain male-biased dispersal, generally based on avoidance of inbreeding. However, previous research on coatis (*Nasua narica*), social carnivores native to the tropics, suggests that they do not follow this pattern. Data from tropical coatis have shown males dispersing socially from natal groups at sexual maturity, but not spatially dispersing since they continue to overlap natal ranges. Tropical females have not been observed to disperse socially or spatially except during group fission events. We used a combination of microsatellite DNA analysis and radiotracking to examine dispersal behavior of coatis at their northern range terminus (Chiricahua National Monument, Arizona). Our data differ significantly from tropical results. In Arizona, female and male coatis both exhibit natal dispersal. Additionally, there is evidence for secondary dispersal in adults of both sexes. Unlike their
tropical counterparts, young males disperse from natal social groups and home ranges. Dispersal in Arizona coatis conforms more to the pattern shown by other social mammals with males dispersing spatially, thus avoiding inbreeding; however, dispersal patterns are less sex-biased than previously reported.

40 LIFE ON THE EDGE: PERSISTENCE OF THE MONTANE VOLE, *MICROTUS MONTANUS* IN A CHANGING CLIMATE.

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Riparian ecosystems are among the most endangered habitats in the southwest and Great Basin. These meadows are significantly impacted by drought, grazing and logging practices, and are likely candidates for perturbation under climate change. Nestled within a mosaic of more xeric habitat, riparian systems support a unique and diverse array of vertebrates, some of which are significantly threatened, such as the riparian brush rabbit, and the montane vole, *Microtus montanus*. The montane vole is a key member of the riparian community. Several factors increase its extinction risk. Like other montane taxa, the montane vole is small, dispersal limited, is characterized by disjunct peripheral populations, and demonstrates an affinity for mesic meadows. The montane vole is generally absent in disturbed or fragmented habitats, which suggests its utility as a bioindicator for riparian health. The primary objectives of this study are to: 1, assess the ecological determinants of the montane vole distribution in the Southwest and the Great Basin, and, 2, to evaluate how climate change may influence its future distribution, and 3, to assess measures of genetic diversity for populations identified in the future niche analysis as impacted by climate change. To accomplish these objectives, I will construct a model of the species niche distribution using GIS and MAXENT software packages. To assess the change in species distribution under perturbation, I will project the distribution onto scenarios of future climate. I will obtain genetic data through sequencing of the cytochrome *b* gene, and estimate genetic parameters using ARLEQUIN.

41 SYSTEMATICS AND DISTRIBUTION OF SHORT-TAILED SHREWS (*BLARINA*) IN ALABAMA

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Two species of short-tailed shrews, the southern short-tailed shrew (*Blarina carolinensis*) and northern short-tailed shrew (*Blarina brevicauda*), occur in Alabama. However, only limited distribution records of *Blarina* exist in the northern part of the state. To clarify distributions of short-tailed shrews in northern Alabama, we examined skulls of *Blarina* obtained from museum collections and from discarded bottles found along roadsides. We used 4 cranial measurements to classify individuals; condylobasal length, cranial breadth, interorbital breadth, and maxillary breadth. Morphometric analysis of crania revealed 2 distinct forms of *Blarina* in northern Alabama. Southern short tailed-shrews occur in the Cumberland Plateau south of the Tennessee River, and a population of intermediate-sized *Blarina* inhabits the Cumberland Plateau north of the river, suggesting that the river forms a geographic barrier between these populations. Genetic analysis should be conducted to elucidate the taxonomic relationship of this intermediate population to other populations of short-tailed shrews in Alabama and adjacent states.

42 MICROSatellite CHARACTERIZATION IN *SPERMOPHILUS TERETICAUDUS*.

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Round-tailed ground squirrels (RTGS), *Spermophilus tereticaudus*, are small (125g) fossorial rodents that inhabit desert areas of the southwestern US. This species may create a female kin-based semi-colonial population structure maintained by male-biased dispersal (Drabeck 1970, Dunford 1977), although no genetic
evidence of relatedness has been provided. A matriarchal social organization has been used to explain various behaviors including increased rates of female vocalizations and incidences of burrow sharing (Dunford 1977). Therefore, we screened microsatellite primers that would be useful in population differentiation and paternity assessment to determine sociality and mating system of RTGS. Microsatellites are valuable as genetic markers because they are co-dominant, detect high levels of allelic diversity and are easily amplified by the polymerase chain reaction (PCR). We screened and characterized 14 pairs of microsatellite primers chosen from previous studies on closely related ground squirrels including Northern Idaho (S. brunnneus brunnneus), Southern Idaho (S. b. endemicus), and Columbian (S. columbianus) ground squirrels. Primers were tested on 11 unique RTGS genotypes. As opposed to individually labeling primers that were not yet known to be polymorphic, we used fluorescent dUTPs in an ABI 3130 to assess genetic variability. Nine of the 14 primers proved polymorphic. Allelic diversity ranged from 2-7 alleles per primer among 11 individuals. These microsatellites markers are an ideal resource for use in population differentiation, spatial structure of relatedness and paternity assessment in future studies of RTGS. In addition the cross-species amplification of these primers may extend their value to research involving other Spermophilus species.

43 COMPARING ENERGETICS AND COST OF TRANSPORT OF GLAUCOMYS SABRINUS AND SCIURUS NIGER

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We compared the cost of quadrupedal transport and locomotion performance in a gliding sciurid, Glaucomys sabrinus, and a non-gliding sciurid, Sciurus niger, to evaluate the likelihood of dispersal of the former in the fragmented forests of Southeast Alaska. Because these two species rely upon different modes of transport, it is likely that they will differ in energetic costs of quadrupedal locomotion and thus respond differently to habitat fragmentation and loss of the vertical forest structure necessary for gliding. Such loss could limit dispersal movements and use of managed habitats by G. sabrinus. Previous research suggests that gliding may have evolved in this species as a means for conserving energy during transport. Therefore, we hypothesized that energetic costs of G. sabrinus would be significantly greater than costs predicted by allometric models based on body mass, indicating a low likelihood that this species would use quadrupedal locomotion for long-distance movements across managed stands. We also hypothesized that energetic costs of S. niger would be similar to those predicted by the models, indicating a higher likelihood of crossing managed stands. We measured energetic costs of transport using flow-through respirometry methods, a variable speed treadmill, and captive colonies of G. sabrinus and S. niger. Our initial analysis indicates that cost of quadrupedal transport was significantly higher than expected for G. sabrinus while measured values for S. niger were less than expected costs. Our data indicate that G. sabrinus are not adapted to the long bouts of quadrupedal locomotion that would be needed to disperse across early seral stands that result from removing forest overstory, whereas S. niger appear to be well-adapted for such long distance movements.

44 THE MATING SYSTEM OF CROCIDURA SHANTUNGENSIS IN A SALT MARSH IN NORTHERN TAIWAN

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The mating systems of shrews living in sub-tropic or tropic areas are rarely studied. A previous review has hypothesized that the mating systems of Crociduridae in those regions should be monogamous (in seasonal climate) or promiscuous (in a seasonal climate), depending on resource seasonality. We tested the hypothesis that the mating system of Crocidura shantungensis in northern Taiwan should be monogamous. We
investigated the spatial relation and genetic relatedness among *Crocidura shantungensis* individuals in a salt marsh during the reproductive season. We used capture-recapture data to infer social mating system from spatial patterns of resident shrews. We used microsatellite markers to assign parentage to 19 litters to inferred genetic mating system. The spatial organizations of 40 resident shrews suggested that the social mating system of *C. shantungensis* was likely facultative monogamy and/or effective polygyny. On the other hand, parentage analysis of population members and multiple paternity within litters showed both females and males mated multiply. Our results rejected the hypothesized model.

45 WHAT ARE THE VERRUCAE THAT ADORN LIPS AND CHINS OF PHYLLOSTOMID BATS?

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Faces of Phyllostomid bats are adorned with varied growths including swellings, folds, a nose leaf apparatus, and distinct regular patterns of verrucae (aka warts, facial projections) juxtaposed to the vermilion border and chin. The verrucae have received some attention from naturalists and most have been termed glandular, although distinct morphological and functional investigations are lacking. As a first attempt to characterize lip-associated and chin verrucae, we describe scanning electron and light microscopic studies of verrucae from various Phyllostomid bats, including *Artibeus jamaicensis*, *Brachyphylla cavernarum*, and *Phyllostomus discolor*. Tissues examined were from specimens collected, fixed, and preserved for other purposes, but they nonetheless were useful in revealing some unique integumentary characteristics heretofore not described in the literature for verrucae.

Histomorphological preparations included techniques for general architecture and nerve tissue. Scanning electron and light microscopic preparations of verrucae exhibited typical hairless and glandless integumentary features. The epidermal-dermal junction was scalloped with well-defined epidermal pegs and dermal papillae. There was an abnormally large amount of dermal innervation. Nerve bundles in the dermis ramified as they approached the epidermal-dermal junction, where they separated into a delicate lattice of individual fibers extending into the stratum basale. Some undifferentiated nerve fibers extended through the epidermis to terminate at the surface of the stratum corneum. Epidermal pegs near the dermal-epidermal junction contained cells that are presumably mechanosensory Merkel cells. The lack of muscular and glandular efferently-controlled tissue in verrucae and the presence of undifferentiated nerve endings and Merkel cells near the surface suggest verrucae serve as expanded and projected surface area for mixed sensory functions.

46 MOVEMENT PATHWAYS OF MEADOW JUMPING MICE AS REVEALED BY POWDER-TRACKING.

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Meadow jumping mice, *Zapus hudsonius*, are widely distributed in eastern North America in a variety of open habitats. Though widespread, MJM are generally reported to be rare relative to other small mammals. As part of a larger study, we investigated movement patterns of *Zapus* using a combination of live trapping and powder tracking. During the 2007 field season, we powder tracked 20 individuals in two distinct habitats - 3 in a wet fen and 17 in a drier old field. These individuals were dusted with UV powder on their venter, hind quarters, and tail and were released at the capture location between 2300 - 0400 hrs. On subsequent nights, a portable UV light was used to locate trails. Trails were flagged every 1m, at which we estimated the height of the trail to the nearest cm and identified the substrate on which the mouse had traveled. Overall trail lengths were variable (3 - 129m). *Zapus* were rarely observed to travel on the ground, mean trail height was 5.8 ± 1.1 cm. *Zapus* were commonly observed to move relatively high into vegetation. Mean maximum trail heights
were 22 ± 13 cm (range: 9 - 67 cm). Past work indicated *Zapus* are capable of moving through vegetation, our study provides supporting evidence and suggests *Zapus* may be more ‘arboreal’ than previously thought.

47 TIME ENERGY BUDGETS OF CAPTIVE NORTHERN FLYING SQUIRRELS IN A SEMI-NATURAL ENCLOSURE.

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We constructed a semi-natural forest habitat in a 7 m by 14 m pole barn with a 7 m ceiling. The habitat consisted of two 5.5 m tall ‘tees’ made of timbers, with attached branches of varying diameters and lengths. The trees were 7.5 m apart in the center of the barn. The habitat was monitored with 5 Reconyx motion sensitive infrared cameras to record all activity by animals in the barn. We released 3 northern flying squirrels (*Glaucous sabrinus bangsi*) in the barn and monitored their activity for 2 weeks in the winter of 2008. Subsequently, we released 9 squirrels (*G. sabrinus griseifrons*) in the barn for 4 weeks, in late winter 2008. We recorded temperatures throughout the barn, as well as in the provided nest boxes. Also, we recorded all positional and locomotor behaviors. We use these data to estimate energy expenditure by the squirrels throughout each day, and determine if the animals budget their activity in a way that reduces overall energetic costs.

48 EFFECTS OF A WESTERN DIET ON MASS, BODY FAT, AND BLOOD GLUCOSE OF *NEOTOMA MICROPUS*.

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Previous research has shown that *Neotoma micropus* populations that are found in close proximity to human populations increase mass, body fat, and bone density compared to populations that are not found in close proximity to human populations. We wished to investigate the effects of a western diet on *N. micropus*. After 8 weeks on a high fat, high carbohydrate diet *N. micropus* increased mass and blood glucose. Compared to a field control population they showed an increase in body fat. Results of our study suggest that the effect of consumption of a western diet may be both positive (mass and fat) and negative (blood glucose).

49 IMPORTANCE OF RESIDENT ENVIRONMENTAL AWARENESS IN CONSERVATION OF URBAN WILDLIFE POPULATIONS

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The proximity of humans and wildlife to each other along the wildland-urban interface results in constant potential conflict between human activity and wildlife populations. Since 2002, California biologists have observed a drastic increase in carnivore mortalities that are associated with exposure to compounds found in common for-indoor-use household rodenticide products (e.g. d-Con). During September-November 2007, 9,000 California households and businesses were surveyed in order to evaluate use of household rodenticide products. More than 2,200 surveys were returned, and 52% of respondents indicated use of rodenticides. Target species not only included mice, rats, and squirrels, but also coyote, bobcat, mountain lion, and kit fox. Ten percent of respondents were aware of potential non-target effects of rodenticide products on local wildlife. Although only 30% of all respondents were very concerned about non-target effects, 40% of those who use rodenticide products indicated that they would change their rodenticide use behavior if the products were affecting local wildlife populations. These results supported the notion that disconnect exists between at least some urban residents, their activities, and the local environment. Although some conflict between humans and
urban wildlife is expected, efforts to establish a better connection between urban residents and the local environment are important in managing urban wildlife populations and guiding environmental policy.

50 BEHAVIORAL DIFFERENCES OF *NEOTOMA MICROPUS* FROM SITES THAT DIFFER IN LEVELS OF HUMAN DISTURBANCE.

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Animal behavior and eating habits can be influenced by human contact. We wished to investigate the differences in behavior of *Neotoma micropus*, from sites that differed in the level of human disturbance, to a novel environment, objects, and food. Our results showed no difference in the tendency of animals to manipulate novel objects. Animals from a disturbed site tended to engage in risk-prone behaviors more often than animals from the less disturbed site. Animals from the more disturbed site were significantly more likely to manipulate and consume a novel food item than were animals from the less disturbed site. Our results suggest that *N. micropus* exposed to human activity behave differently with respect to novel stimuli than *N. micropus* not exposed to human activity.

51 SEASONAL DEN USE OF THE NORTH AMERICAN PORCUPINE (*ERETHIZON DORSATUM*) IN NORTHERN NEW YORK

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North American porcupines (*Erethizon dorsatum*) are distributed across a wide variety of habitats. Unlike some of their rodent counterparts of a similar size (e.g. woodchucks, *Marmota monax*) porcupines remain active year-round and survive the winter months by relying on fat reserves and a nutritionally poor diet of tree bark. In northern New York, porcupines occur most abundantly in northern hardwood forests, and use primarily three types of dens: underground burrows in rocky substrate (rock dens), cavities in trees (tree dens) or occasionally the canopy of hemlock (*Tsuga canadensis*) trees (roost trees). We monitored a representative group of each type of den between June 2007 and May 2008 with temperature loggers to determine thermal characteristics of each den type across seasons. At each den, we placed one logger in the den cavity and a second logger adjacent to the den to measure ambient temperature. We also monitored porcupine activity at each type of den via camera traps set near den entrances. We also characterized habitat around each den in our study areas. Typical summer average minimum den temperatures were 11.25°C and average maximum den temperatures were 23.32°C. Comparing among den types, roost trees were coolest and tree dens were warmest in the summer but the magnitude of difference between den types was only about 2 degrees. Typical winter average minimum den temperatures were -15.37°C and average maximum den temperatures were -1.14°C. Comparing among den types, roost trees were coolest and rock dens were warmest in the winter and the magnitude of difference between den types was about 4 degrees. In general, porcupine activity was highest between 00:00 h and 03:00 h and lowest between 12:00 h and 15:00 h. Cold temperature did not appear to inhibit nocturnal activity by porcupines.

52 SMALL MAMMAL COMMUNITY RESPONSE TO RECLAMATION FOLLOWING MOUNTAINTOP REMOVAL IN EASTERN KENTUCKY

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Although mountaintop removal is a common, and controversial, practice in Eastern Kentucky, there have been few studies on the impact of such techniques, especially concerning small mammal communities. In the Midwest United States, small mammal community compositions have shown change due to strip-mining. It is possible that the process of disturbance and reclamation could create new habitat for rare grassland species. The purpose of this study was to document small mammal communities in reclaimed mountaintop removal and valley-fill sites and to compare with small mammal communities in natural, unmined areas as well. We used a total of four different trap types per station in an attempt to maximize trapping success for different species. Mark-recapture methodology was used to estimate populations. Results were standardized per 100 trap-nights for comparison between sites. In comparing densities and community diversity, there were more individuals captured in natural areas, but the reclaimed sites had higher diversity. However, this result is slightly misleading because two of the three sampled mountaintop sites had only one species of Peromyscus present.

53 Launch Kinematics in Sugar Gliders (Petaurus breviceps)

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We used video capture and an instrumented branch to measure peak take-off force, initial velocity, and angle of attack for short glides by captive Petaurus breviceps. Sugar gliders exhibited typical gliding behaviors even over distances as short as 1 m. The velocity profiles showed initial acceleration followed by deceleration just prior to landing. Deceleration corresponded to an increased angle of attack, suggesting active stalling before landing. Peak take-off forces were large compared to those of small flying squirrels, and increased with increasing glide distance and increasing glide velocity. Initial velocity was not linearly dependent on body mass, and take-off angle decreased with increasing glide distance. The animals did not maximize ballistic range and did not maximize take-off velocity. We use the results to assess the predator avoidance and controlled landing hypotheses for the evolution of gliding.

54 Diet Analysis of a Maternal Colony of Big Brown Bats (Eptesicus fuscus) in Floyd County, Kentucky

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Bats are the second most diverse group of mammals, after rodents. However, because bats are volant and capable of traveling over a large area in a short amount of time, their ecology is difficult to study. Bat diet studies typically focus on contents of their guano (droppings). The main objective of this study was to identify contents of guano from a maternal colony of Big Brown Bats, Eptesicus fuscus, in Floyd County, KY. Samples were collected weekly between April (when the colony reformed) and September 2007. Pellets were dissected in lab and contents identified to the lowest possible taxonomic level possible. Our data support previous literature from other regions indicating that E. fuscus is a specialist on beetles; however, through the summer, there was a change in percent composition and content of several non-beetle dietary items. These findings may indicate that the bats may specialize in beetles but also supplement with other insect prey whose abundance varies seasonally. Continued study of food habits allows for greater understanding of E. fuscus in general, its interaction with the environment, and conservation and management strategies.

55 Palaeoecological Diversity of Quaternary Caves in Central Pennsylvania: A Methodology

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With such rapidly growing topics of global climate change and evolution, evaluations of paleocommunities are recognized as a highly important area of research. Caves and karst topographic features have long been utilized for their abundance of aggregated fossil remains, and are frequently used as excavation sites in paleological studies. Central Pennsylvania's geography is predominated by calcareous limestone which allows the region to form and maintain elaborate and stable cave systems. The objective of this study is to begin a series of excavations in regional caves to determine the diversity of vertebrate paleofauna within Pleistocene and Holocene sediments. The excavated sediments will be systematically removed maintaining original stratigraphy, bagged and weighed before being sorted. Unconsolidated sediments will be removed with forceps and sorted into class while consolidated materials will be washed through a series of stacked screens of decreasing size, dried, bagged, and labeled accordingly. Specimens will be identified to the species level whenever possible using reference and museum collections and selected samples from fossil material will be radiocarbon dated. All collected materials will be stored and curated at the SU Natural History Teaching and Research Collection. The paleoecological diversity of the cave system will be analyzed within each stratum to possibly determine effects of the cyclic glaciations periods of the last million years. Species lists and importance values will be compared against baseline data from extant vertebrate communities. Taking taphonomics into account, we plan to include in our analyses minimum number of individuals, and total number of identified species to calculate relative species abundance and taxonomic habitat index. We anticipate this study will provide data that could be use to predict future patterns in climate-habitat fluctuations and vertebrate assemblage modifications.

56 EMERGENCE TIME OF MYOTIS LUCIFUGUS: EFFECT OF BODY MASS AND CLIMATIC CONDITIONS

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Emergence time is the time at dusk that an individual bat leaves its' roost to forage for the night. The emergence time of little brown bats (*Myotis lucifugus*), and ultimately their foraging strategy, is based on the trade-off between predation risk and competition from birds with the availability of prey and variations in energetic demands. If bats emerge late, they miss foraging opportunities at a time of peak prey abundance. However, early emergence increases exposure to predators and increases competition with birds. Depending on an individual bat's energetic needs, they will emerge as soon as the benefits outweigh the risks. *Myotis lucifugus* were trapped using mist nets and harp traps at maternity colony in a two-story barn in Selinsgrove, Pennsylvania. Standard data (sex, age, weight, forearm, and PIT tag or band numbers), along with climatic conditions (temperature, relative humidity, barometric pressure, wind speed, precipitation, light levels, and moon phase) were recorded for 15 trap nights during 8 weeks from August through October 2007. An ANCOVA shows that body mass is a significant covariate (P = 0.0373) when date of capture, sex, and age are controlled for. Bats with a smaller body mass emerged earlier during the emergence period probably because of their low body reserves and ultimate desperation to find food. A regression model (R^2 = 0.257, P < 0.0001) shows, that in addition to body mass, climatic conditions including high and low daily temperatures, wind speed, precipitation, and moon phase influence emergence time.

57 SHE LOVES ME, SHE LOVES ME NOT: FEMALE MATE PREFERENCES IN A WOODRAT HYBRID ZONE

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Hybrid zones are productive arenas for research because the genomic mixing that characterizes such regions provides unique insight into evolutionary forces that operate at the spatial and genetic interface between species. Because hybridization in animals is fundamentally a behavioral phenomenon, analyses of mating behaviors allow us to address how hybrids are generated, rather than simply addressing the consequences of
the hybridization. We conducted female mate preference experiments on two species of woodrats, *Neotoma lepida* and *N. bryanti*, from southern California. Purebred females from sympatric populations where hybridization is known to occur, as well as females from allopatric populations were allowed to investigate both conspecific and heterospecific males in a modified Y-maze apparatus. Males were tethered so that a female could approach and even copulate with test males without the risk of being injured by an aggressive male. Results indicate that females from within the hybrid zone prefer conspecific males, whereas females from allopatric populations have relaxed mating preferences. These findings support the reinforcement theory and provide breeding predictions that can be tested with paternity data from the hybrid zone.

58 THE SPACE-TIME CONTINUUM AND RESPONSES BY SMALL MAMMALS TO FOREST-MANAGEMENT EXPERIMENTS

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Small mammals are often a focal group for studies comparing forest management options, yet spatially and temporally inconsistent responses to silvicultural treatments are the rule for many common and widespread species. Across their ranges, within regions, and within local landscapes, species such as the deer mouse (*Peromyscus maniculatus*) and southern red-backed vole (*Clethrionomys gapperi*) have shown highly variable numeric responses to logging. As a result, studies that describe local population-level responses to treatments often do not produce clear recommendations for managers. Small mammal responses often co-vary with environmental factors, habitat responses to treatments, and the occurrence of competitors. For example, both across its range and within western Washington, Keen’s mouse (*P. keeni*) is most tolerant of forest disturbances in cool, moist environments and in landscapes where the deer mouse is rare or absent. Abundance of most species can vary dramatically among years, and short-term responses will be influenced by initial conditions at the time of harvest. Moreover, responses to treatments may occur at variable rates among sites. Researchers examining the effects of silvicultural treatments on small mammals need to be realistic about what can be gained from short-term studies (experimental or correlative) that simply document population-level responses. Even when evaluating specific management actions (e.g., precommercial thinning) within a region, researchers need to combine experimental with chronosequence studies that expand the temporal frame of inference. Broad-scale regional studies need local replication of treatments to determine the strength of spatial variation in responses. More importantly, to adequately address questions of interest to managers, researchers need to evaluate explicitly the underlying mechanisms of small mammal responses, and the sources of variation that are associated with those responses.

59 USE OF FLUORESCENT DYE FOR DETERMINATION OF DIFFERENTIAL LOG USE OF *PEROMYSCUS* SPP., *MYODES GAPPERI*, AND *ZAPUS HUDSONIUS* IN ITASCA STATE PARK, MINNESOTA.

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Fluorescent dye has been used to study behavior, habitat selection, estimate home range, and quantify path selection by small mammals. This study examines log use by three different Minnesota small mammals: *Peromyscus* spp., *Myodes* (*Clethrionomys*) *gapperi*, and *Zapus hudsonius* in Itasca State Park, Clearwater Co., MN. During June of 2006 and 2007, 13 *Peromyscus* spp., ten *M. gapperi*, and three *Z. hudsonius* were captured, coated with fluorescent dye and released. Trails were followed at
least 24 hours after release. Travel distance on the ground and on top of or underneath logs was measured to find frequency of log use by each species. Our study indicates that Peromyscus spp. used logs significantly more frequently than did M. gapperi or Z. hudsonius. Additionally, Peromyscus males used logs significantly less often than did females. Previous research suggests that log use decreases risk of predation, and this study might indicate that log use by Z. hudsonius and M. gapperi may not confer a survival advantage, at least to the extent that log use does for Peromyscus. Alternatively, Z. hudsonius and M. gapperi may be inherently less vulnerable to predation than Peromyscus, perhaps because of their modes of locomotion and/or differential microhabitat use. Different reproductive strategies may explain the difference in log use between male and female Peromyscus spp. Males might be covering larger distances in order to contact as many females as possible and find movement independent of logs an evolutionarily acceptable tradeoff versus increased survival associated with travel near logs.

60 MODELING THE SPATIALLY EXPLICIT ANIMAL RESPONSE TO COMPOSITION OF HABITAT (SEARCH)

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Spatially explicit population models (SEPMs) show promise as tools for conservation, but have been criticized for emphasizing landscape configuration while being behaviorally minimalist. We present a SEPM that simulates animal dispersal across complex, realistic landscapes while modeling a variety of search processes and habitat selection rules. SEARCH can be used to simulate the spatially explicit response of solitary animals to habitat composition over successive dispersal seasons, at fine temporal scales, on temporally dynamic, high-resolution landscapes. In SEARCH, animals move across a vector-based landscape with values assigned to each point in space to reflect animals’ response to habitat characteristics. Changes in habitat quality or arrangement can be reflected by replacing the landscape maps at dates and times scheduled by the user. Animals are also parameterized to reflect behavior, energetics, and home range requirements. Baseline values can be modified to reflect variability caused by gender, activity mode, behavioral mode, time of day, and date. Dispersing animals retain a memory of habitat suitability and query that memory in combination with user-parameterized selection rules to locate and delineate home ranges. As SEARCH can be run for multiple years, resident females reproduce annually, giving birth to a user-parameterized number of young. Output at the individual-level includes the animal location, energetics, predation risk, movement parameters, and shapefiles depicting the area perceived during dispersal. At the population-level, shapefiles depicting the arrangement of home ranges are produced and population demographics (e.g. age structure) can be obtained from individual-level data. To demonstrate SEARCH’s capabilities, we describe our use of SEARCH to investigate raccoon recolonization of forest patches following local extirpation in Indiana.

61 REINTRODUCTION OF THE STATE-ENDANGERED EASTERN WOODRAT (NEOTOMA FLORIDANA ILLINOENSIS)

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Woodrats once occurred in suitable habitats throughout southern Illinois. They are now found naturally (not reintroduced) at only 4 sites in the state: LaRue Pine Hills, Fountain Bluff, Little Grand Canyon and Horseshoe Bluff. With the possible exception of LaRue Pine Hills, these populations are very small and isolated from each other. Natural recolonization of sites historically occupied by eastern woodrats in Illinois is unlikely because current land uses represent barriers to successful dispersal. Long-term isolation of these populations has also reduced genetic variability, possibly affecting reproductive vigor. Translocations among existing populations and from sources outside Illinois were a logical approach for improving distribution and genetic diversity. We removed *N. f. illinoensis* from several different sites in Missouri and Arkansas to minimize local or regional impacts of our activities and to obtain individuals that were genetically diverse. From 2003 to 2008, we translocated 391 woodrats to five locations in southeastern Illinois. All were "soft releases" in that food and cover were provided but animals were not restricted in their movement away from release sites. The minimum known survival rate 1 month after release was approximately 8.8%. We documented reproduction based on 64 unmarked woodrats subsequently trapped, and successful dispersal of individuals away from the reintroduction release sites. We also translocated 41 woodrats from Missouri and Arkansas to LaRue Pine Hills and 6 woodrats from Missouri to Fountain Bluff in an attempt to increase the genetic diversity of those populations. The impact of these translocations will be determined by future analyses.

62 CRANIOMETRIC VARIATION IN CALIFORNIA VOLES (*MICROTUS CALIFORNICUS*)

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The California vole is an arvicoline rodent with a distribution from SW Oregon through California into northern Baja California, Mexico. This species is found in a variety of habitats from sea level up to 6,000 feet. It is also polytypic, including about 16 subspecies. The first major revision of subspecies (Kellogg 1918) used pelage color and skull characteristics to delimit subspecies boundaries. This work also included 12 measurements for 66 representatives of all recognized subspecies at that time. As a preliminary study of morphological variation in this species, I re-measured all of the available skulls at the MVZ that Kellogg used, adding 3 new measurements, but removing 2 that were highly correlated with others. I also increased the sample size to include more geographic variation. I re-analyzed the data with multivariate techniques to examine variation within and among recognized subspecies, and in context of a large mitochondrial phylogeographic break (Conroy and Neuwald 2008). The results of these analyses will be presented.

63 SURVIVAL OF PRONGHORNS IN WESTERN SOUTH DAKOTA

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Survival and cause-specific mortality of pronghorns (*Antilocapra americana*) have been well-documented in several western states and Canadian provinces. However, no information has been collected in western South Dakota, USA, where mixed-grass prairie habitats characterize rangelands. The objectives of our study were to determine survival and cause-specific mortality of adult (> 18 months) and yearling (6–18 months) pronghorns and to determine monthly and summer (Jun–Aug) survival for neonatal (< 1 month of age) pronghorns in South Dakota. We radio-collared 93 adult female and 142 neonatal pronghorns on 3 areas in western South Dakota. We used bed sites from initial neonate captures to collect microhabitat information throughout Harding and Fall River counties. We measured vegetation understory and overstory height, shrub canopy, and distance to nearest concealment cover to the nearest centimeter inside 1-m2 quadrats by collecting measurements at 15 random points within a 30-m radius of the bed site. We documented that coyote (*Canis latrans*)
predation was the primary cause of mortality for neonates in western South Dakota and that microhabitat characteristics at neonate bed sites differed between northwestern and southwestern South Dakota.

64 ACTIVITY PATTERNS OF MIGRATORY BATS IN MINNESOTA

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Three bat species present from spring through fall in Minnesota migrate outside of the state during winter. Based upon collected individuals, eastern red bats (Lasiurus borealis) and silver-haired bats (Lasionycteris noctivagans) occur in the state from April through October and hoary bats (Lasiurus cinereus) between May and September. Passive monitoring of foraging bats, using the AnaBat bat detector system (Titley Electronics, Ballina NSW, Australia), was conducted to document arrival and departure times of these species and to document patterns of local activity of all bat species between spring and fall. Bat detectors were set at 26 locations between 2003 and 2007, distributed throughout Minnesota. Dates and duration of operation varied among locations, ranging between 42 and 196 nights. Bat call data supported arrival and departure dates for L. borealis and documented that L. cinereus is present during the same period. The activity patterns of these two species, during their presence in Minnesota, varied among locations and in some instances differed substantially from overall bat activity. Landscape features and other environmental factors are discussed as possible explanations for the observed variation.

65 MODELING OCCUPANCY OF AMERICAN MARTEN (MARTES AMERICANA) ACCOUNTING FOR SPATIAL EXPLICIT VARIABLE

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Occupancy modeling is important in estimating how a species is detected on a landscape by different sampling techniques. It's also an indirect index the changes of population abundance over time and space. Occupancy (\(\phi\)) is defined as the probability that a selected site is occupied by a species, and the detection probability (p) is the probability that the species is detected during the sampling of an occupied site. Most of the occupancy models are spatially implicit due to lack of robust spatial variables. We incorporated spatial factors into occupancy models by using independent utilization densities, the intensity of space use by an animal in its kernel home range, as covariates thereby making our models spatially explicit. We used American Marten (Martes americana) in northern Wisconsin as the example species to develop an occupancy model with utilization densities incorporated as spatial covariates to estimate the detection probability of hair snares set inside and outside of known Marten home ranges. We illustrate the modeling process by using software PRESENCE. The naïve occupancy probability is 0.1392 and 0.2769 in 2005 and 2006. The estimated occupancy probability (\(\phi\) hat) is 1.00 and 0.3055 in 2005 and 2006. The averaged detection probability (p) is 0.0464 and 0.4155 in 2005 and 2006. We then use the Monte Carlo simulation scenarios for space use by marten to optimize the sampling scheme of hair snare survey based on the results of spatial explicit occupancy modeling. The sampling schemes include number of snares, frequencies of surveys, and locations of snares in different gradients of utilization densities of home range. We conclude by examining the improvement of detection probability estimates at each snare trap.
MODELING OF SWAMP RABBIT (*SYLVIAGUS AQUATICUS*) DISTRIBUTION IN SOUTHEAST MISSOURI

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Understanding a species’ geographic distribution is vital to the conservation and management of that species. Former methods for depicting distributions could include substantial areas of unsuitable habitat; however, recent developments alleviate this problem by choosing areas in environmental space rather than geographical space. With the availability of these innovative methods, heritage data could potentially provide a cost-effective means of creating superior predictive distribution maps. The objectives of this study were to assess the validity of the Missouri Mammal Database as a basis for spatial analyses, to compare the efficacy of different modeling methods for Missouri’s available data, and to create maps predicting the spatial distribution of selected species of conservation concern. The swamp rabbit (*Sylvilagus aquaticus*), a game species that is imperiled at the state level but globally secure, was one of five species chosen for this study. Latrine surveys were completed on public lands from July 2007 to March 2008. Multiple modeling methods (DIVA-GIS, Desktop GARP, MAXENT, and PRESENCE) were used to predict the swamp rabbit’s geographic distribution across its historic Missouri range. Production of a high resolution predictive distribution map will aid the Missouri Department of Conservation in the conservation and management of this species. Furthermore, an evaluation of the validity of these modeling methods given the current information available statewide will provide a foundation for the creation of predictive distribution maps for many Missouri species of all taxa.

ROOST SITE USE AND SELECTION BY RAFINESQUE'S BIG-EARED BATS

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Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) is a species of concern throughout its range. Although there have been several studies on use and selection of artificial roost structures by this rare species, only a few studies have examined use of natural roosts and none have examined roost selection. Further, roost site use and selection may vary with habitat quality. The objective of this study was to determine roost use and selection of Rafinesque's big-eared bats in the upper Coastal Plain of South Carolina. The study was conducted on the Savannah River Site, an area that has experienced extensive land use and disturbance for >200 years. Roosts were located through tree searches and radio-telemetry during April-October 2005-2007. Tree and microhabitat data were collected on each tree roost and a corresponding random tree. Four bridges, 1 barn, and 47 trees were used as roost sites. Tree roosts were located in tupelos (48.9%), oaks (23.4%), sweetgums (14.9%), cypress (4.3%), and miscellaneous other species (8.5%). The majority of roosts (89.4%) were in live trees and in hollows with basal openings. However, upper bole cavities were also used, including a woodpecker cavity. Tupelos were used in greater proportion than their availability (28.1%) whereas oaks and sweetgums were used in proportion to their availability. Roosts were significantly larger in diameter than random trees but did not differ in height or distance to the nearest tree. Although the majority of roosts (87.2%) were in bottomland hardwood or swamp habitats, 12.8% were located in pine-hardwood or upland hardwood stands. Bats on Savannah River Site used a greater diversity of tree species and forest types than bats inhabiting more intact sites. These results suggest that roost site use and selection vary with habitat quality and land use history.
68 FACULTATIVE MUTUALISM OR COMPETITION BETWEEN O. NUTTALLI AND P. LEUCOPUS?

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Coexistence of species with similar life histories, body mass, and behavioral activities has long been of interest to mammalogists and ecologists. The golden mouse (Ochrotomys nuttalli) and the white-footed mouse (Peromyscus leucopus) have similar body mass, home range size, nest-site and food preferences, periods of activity and reproduction, and both are semiarboreal (Goodpaster and Hoffmeister, 1954; Knuth and Barrett, 1984; Christopher and Barrett, 2006; Barrett and Feldhamer, 2008). Therefore, there exists a significant amount of niche overlap between these two small mammal species. Small, but significant, differences in food resource partitioning, nesting behavior, 3-dimensional use of habitat space, bioenergetics, and thermoregulation partially explain differences in niche overlap. Findings, however, such as interspecific, simultaneous, double captures in a single live trap (Christopher and Barrett, 2007), both species collected from the same nest in the wild (Barrett, 2008), and on 1 March 2008 a scrotal male O. nuttalli and a scrotal male P. leucopus collected from the same nest box bring into question the actual relationship between these two species. Water oak (Quercus nigra) acorns were cached in this nest box as well. We encourage investigators to design studies to determine if the relationship between O. nuttalli and P. leucopus should be considered facultative mutualism (food caching, nest construction, thermoregulation) rather than interference or exploitation competition.

69 ARE WHITE-FOOTED MICE MORE ABUNDANT IN THE INTERIOR THAN IN THE EDGES OF FOREST FRAGMENTS?

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The white-footed mouse (Peromyscus leucopus) has a negative relationship between density and forest fragment size. This may be in part because smaller fragments have a greater proportion of edge to interior habitat, and edge habitat contains a greater structural complexity of understory vegetation than interior habitat. Understory vegetation can provide both food and cover from predators. Our research has shown that P. leucopus is more abundant in edge habitat (0-15 m from the matrix) than in more interior habitat (40-50 m). Our definition of edge is based on significant differences in the structural complexity of the understory vegetation between the first 15 m of forest and more interior areas. Some other research suggests that P. leucopus is actually more abundant at farther distances from the matrix (90-100 m). Our study design has prevented us from sampling at these “deep interior” distances since six of our study fragments are <2 ha (and have no areas 100 m from the matrix on all sides). In order to test whether P. leucopus are more abundant >50 m from the matrix, we placed grids of live traps along edge-to-interior gradients in our three large (>100 ha) fragments. We found no relationship between the relative abundance of mice and the distance from the matrix at which they were trapped. We also measured the complexity of the understory vegetation at each trap and averaged these scores for each distance from the matrix. Although understory vegetation is generally more complex in the first 15 m, the vegetation scores were surprisingly not related to the distance from the matrix. However, there was a significant positive relationship between the abundance of mice and the vegetation scores. These results emphasize the importance of including vegetation complexity in studies of the abundance of P. leucopus and suggest that vegetation structure rather than distance from the matrix helps to determine the abundance of P. leucopus in forest fragments.
70 PHYLOGENETIC STATUS AND POPULATION GENETIC STRUCTURE OF THE ARIZONA SHREW (*Sorex arizonae*)

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Little is known about the phylogenetic relationships and population genetic structure of the Arizona shrew (*Sorex arizonae*); a small mammal restricted to a few mountainous areas of southern USA and northern Mexico. Information on genetic variability is needed, as the species is restricted to small and fragmented habitats in these Sky Islands of the southwest. Using mitochondrial cytochrome-\(b\) sequences and 12 microsatellite loci, we assessed genetic differentiation among 63 individuals from four mountain ranges in Arizona and New Mexico: Animas, Huachuca, Santa Rita, and Chiricahua ranges. \(F\)-statistics indicate that significant population differentiation has occurred among the Chiricahua and Animas populations compared with the other two populations. We found a unique haplotype for the Animas population, while the other mountain ranges shared the most common haplotype. Phylogenetic analysis using cytochrome \(b\) sequences confirmed that the Arizona shrew is most closely related to *S. trowbridgii* among North American shrews that have been sequenced for the mt DNA cytochrome-\(b\) region to date. Both are placed in a monophyletic group basal to a clade consisting of Nearctic shrews of the subgenus *Otiorox*. Our results suggest that these species have a high level of evolutionary divergence from other North American shrews. Given the inherent vulnerability of these naturally isolated local populations with their fragmented distributions, the genetic data supports a need for conservation efforts focused on protection of well-vegetated riparian zones and associated upland, ridgelines with moisture, and mountain top saddles where our field work indicates preference by *S. arizonae*.

71 THE CONTACT ZONE BETWEEN TWO SPECIES OF SHORT-TAILED SHREW (*Blarina*) IN IOWA AND MISSOURI

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Short-tailed shrews (*Blarina* spp.) are characterized by divergent karyotypes and can be distinguished genetically, but they are indistinguishable morphologically and similar morphometrically. Possibly as a result of this similarity, distributions of *Blarina* species tend to be parapatric along well-defined contact zones. The best studied contact zone separates the Elliot’s short-tailed shrew (*B. hylophaga*) and the northern short-tailed shrew (*B. brevicauda*) in Nebraska. However, morphometric data have suggested that these species occur sympatrically in Iowa and Missouri. To ascertain their actual distributions and determine the extent of hybridization between them, we collected 179 specimens in southwestern Iowa and northwestern Missouri. Total length (for tentative identification) and karyotypes were used for field identification and to help locate the contact zone. Amplified fragment
length polymorphism (AFLP) analysis was used to verify species identification and to investigate the extent of hybridization based on comparison with reference samples from outside the contact zone. Field identification and AFLP analysis grouped 178 of the 179 specimens into either *B. brevicauda* or *B. hylophaga*. The unidentified specimen, despite having a *B. brevicauda* karyotype (2n = 50), was intermediate in size and did not group with either species in the principal components analysis of the AFLP data. The specimen was collected sympatriically with *B. brevicauda* and just north of a *B. hylophaga* locality. No locality yielded both species; however, both species were found approximately 3.7 km from each other at the narrowest point. Therefore, the possible hybrid individual indicates that introgression between the two species might be minimal and found in a narrow contact zone that isolates *B. hylophaga* in southwestern Iowa and northwestern Missouri. However, further research is needed to understand the relationship of the two species in the narrow gap between them.

72 POSTGLACIAL EXPANSION OF *URODERMA BILOBATUM* (CHIROPTERA: PHYLLOSTOMIDAE) IN THE NEOTROPICS;

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Advances in Phylogeographic statistical analyses have open new avenues to better understand biodiversity patterns in complex geographic areas such as the Neotropics. Phylogeographic statistics has also contributed to narrow the historical gap that exists between morphological and genetic analyses putting both sources of information in a geographic context. A battery of new Geographic Information Systems analyses, in combination with traditional morphometric and molecular methods were applied to investigate the Phylogeographic relationships of Peter's tent making bat *Uroderma bilobatum* complex in South America. The new analyses of genetic isolines (AGIL), and the morphometric isolines (AMIS) proved to successfully sort out the genetic and morphological complexity found within *U. bilobatum*. As a result, three phylogroups supported by both morphological and genetic geographic structure were identified: 1) *U. sp. nov.* from the Andes of northern Venezuela, 2) *U. convexum* distributed on the western versant of the Andes, and 3) *U. bilobatum* from the lowlands of eastern South America and the piedmonts of the south-eastern Andes. The present analyses in conjunction with estimated divergence dates also revealed a postglacial expansion of the *U. bilobatum* complex in South America, originated in the northern portion of the Andes. The Andean system as refugia and "pump of species" for the lowlands of the Amazon basin is a mechanism of dispersion not reported in the literature for Neotropical bats.

73 BIOGEOGRAPHY OF SOUTHERN LESSER ANTILLEAN BATS

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While the Chiropteran fauna of many Caribbean islands is well documented, the bat fauna of a number of southern Lesser Antillean islands is known only from scattered or incomplete records. Therefore knowledge about the origin and diversification of southern Lesser Antillean bats is limited. Given this paucity of information we conducted field surveys in 2005, 2006, and 2007 on several southern Lesser Antillean islands. Our goals were to document bat species diversity and to investigate the biogeographic and evolutionary histories of bats of the southern Lesser Antilles. We report new species records and unrecognized species diversity from the islands of St. Lucia, Barbados, St. Vincent and the Grenadines, and Carriacou. Additionally we present phylogenetic and phylogeographic results from several species distributed throughout the region.
Our results indicate that the Lesser Antillean bat fauna is the result of multiple invasions and subsequent radiations from the Greater and northern Lesser Antilles and from northern South America.

74 BIOGEOGRAPHY AND EVOLUTION OF THE FRUIT BATS, PTEROPODIDAE (CHIROPTERA)

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The fruit bats, family Pteropodidae are, after Vespertilionidae, the most speciose family of Chiroptera, with a minimal estimate of 186 contemporary species (17% of all bats) widely distributed throughout the Old World Tropics. Notwithstanding this appearance of commonality, numerous new species of Pteropodidae are being discovered on an annual basis, and many species in the family remain relatively rare, such that molecular analyses often are hampered by lack of taxonomic representation as well as by representation within species to assess the extent of genetic variation. We assessed molecular variation among a broad representation of pteropodid species from Africa, South, and Southeast Asia, including the newly described Styloctenium mindorensis from Mindoro Island, Philippines. Our findings suggest that current geography is not necessarily an indicator of phylogenetic relationships: some Southeast Asian species are more closely related to African taxa than to morphologically indistinguishable apparent congeners. Assuming that Hipposideridae and Rhinolophidae split from a common ancestor with Pteropodidae approximately 50 MYA, a lineage though time plot shows that initial diversification among Pteropodidae was slow, followed by a cladogenic explosion between 20 and 30 MYA. Genera with sister species in the Philippines and archipelagic Southeast Asia show different times for cladogenesis: Harpyionycteris diverged approximately 4.2 MYA, whereas Styloctenium species diverged approximately 11.6 MYA. Even allowing for the habitual errors associated with calibration of a molecular clock, the divergent temporal estimates suggest lengthy periods of ongoing faunal exchange among islands in the Southeast Asian archipelagos, complicating an already complex biogeographic picture.

75 POPULATION STRUCTURE OF COMMON VAMPIRE BATS IN ECUADOR: TESTING TRANS-ANDEAN GENE FLOW

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Common vampire bats (Desmodus rotundus) have economic and public health importance, for factors including losses caused to cattle ranching and transmission of zoonotic agents. Common vampire bats are widely distributed in the Neotropics, and historically all the populations have been considered as a single unit however, this has been recently challenged by the use of molecular markers revealing cryptic species. Herein we test the hypothesis of the Andean system as an effective barrier preventing gene flow between populations from both the eastern and the western versants of the system. In order to test our hypothesis we explore the genetic constitution of populations distributed along a Trans-Andean transect in southern Ecuador, ranging from 251 m on the western side up to an elevation to 2,142 m in its maximum level, and descending to 875 m on the eastern side. Additional museum samples were also used to add robustness to the data set and allow comparisons with other regions of Ecuador. The entire Cytochrome-β gene was sequenced for 108 individuals, and phylogenetic analyses were conducted in conjunction with computational geographic analyses. Two highly divergent phylogroups were recovered, belonging to either side of the Andes. Despite the high human disturbance in the Andean region allowing the potential overlap in the current distribution of both
phylogroups, no signals of maternal trans-Andean gene flow and dispersal were recovered. It is possible that relict Andean forests are the features that may serve as a barrier for gene flow between both populations because of the low number of large prey for vampire bats. Our results support the Andes as a key element in shaping the diversity of the region restricting taxa to either side, and leads to uncertainty on the actual number of bat species common to both sides of the Andes.

76a SYSTEMATICS AND SPECIES BOUNDARIES OF *DERMANURA* (PHYLLOSTOMIDAE: STENODERMATINAE)

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We reviewed the systematics and taxonomy of the small fruit-eating bats, genus *Dermanura* (Phyllostomidae: Stenodermatinae), based on application of the Genetic Species Concept with extensive taxon and geographic sampling, phylogenetic analyses of cytochrome-b gene sequences, and detailed morphological diagnoses. We recognized 12 *Dermanura* species (*anderseni*, *azteca*, *bogotensis*, *cinerea*, *glauc*a, *gnoma*, *incomitata*, *phaeotis*, *rava*, *rosenbergi*, *tolteca*, and *watsoni*), of which 3 (*bogotensis* Andersen, *rava* Miller, and *rosenbergi* Thomas) have been considered synonyms of *cinerea*, *glauc*a, and *phaeotis* by various authors. Our results also reveal a geographic component to the diversification of *Dermanura*, including an ancient connection between Western Andean and Middle American biota. In South America, no species has been recorded from both sides of the Andes, and at least 1 clade (*glauc*a, *gnoma*, and *bogotensis*) is restricted to the Amazonian versant of the Andes. These biogeographic patterns, along with our genealogical hypotheses, are represented in a robust phylogenetic framework that will facilitate future studies of these bats. Brief morphological and geographic delimitations are provided for each species.

77 THE BASICRANIAL ANGLE AND HEAD CARRIAGE IN GLIRES

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The rostrum and the braincase in most mammals, at most, form a slight angle with each other but in certain Glires (Leporids, Steagaulata = “Sciuromorpha”) a distinct bend is visible between the two parts, creating a curved skull. Since gliroids can only produce overlapping visual fields by looking over the rostrum, the head must be bent downward to do this. The curved skull exaggerates the overlap. The structure of the occipital condyles reflects the enhanced ability to bend the head downward, a line between their midpoints being closer to the bottom of the foramen magnum than in unbent rodent skulls.

78 MULTIVARIATE MORPHOLOGICAL ANALYSIS OF NICHE PARTITIONING AMONG COSTA RICAN BATS

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The competitive exclusion principle hypothesizes that two highly similar species should not be able to coexist in tight sympatry. Either one species is removed through competition, or both evolve mechanisms to reduce niche overlap, for example by character displacement. The most comprehensive definition of ecological niche is G. E. Hutchinson's multi-dimensional hypervolume, for which feeding ecology serves as a major component
of niche dimension. The feeding niche has traditionally been approximated from a morphological perspective by measuring morphological features relevant to animals' foraging abilities, thereby enabling visualization of how animals in a community partition multivariate niche space. In this study, I evaluated the feeding niches of Costa Rican bats using multivariate statistical analyses of 82 cranial and skeletal measurements. Measurements were taken with digital calipers from skins and skulls of 875 specimens representing 111 species. Data were analyzed using principal component analysis to visualize niche partitioning and assess niche breadth and overlap within the bat assemblage and ensembles. I hypothesized that there would be little morphological overlap among species and that all of the multivariate morphological space would be optimally occupied, that is: maximal utilization of morphological multivariate niche space would lead to little or no overlap among species, but occupation of essentially all available niche space. My hypotheses were not rejected. These ecomorphological data suggest that bats divide niche space—hence use their habitat—in an extremely fine-grained manner, presumably as a consequence of extensive interactions at the community level.

79 THE RELATION OF TRAGUS SIZE AND EXTERNAL EAR MORPHOLOGY TO FORAGING ECOLOGY IN PHYLLOSTOMIDAE

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Chiropterans use various methods to overcome obstacles posed by their foraging environments; this study examines the relationship of external ear characteristics to membership in different feeding guilds and foraging tactics in bats of the family Phyllostomidae. Previous studies of external ear characteristics have not included the tragus in their comparisons, even though studies examining the function of the tragus have shown it to interfere with sound entering the ear. We believe the tragus should be included in external ear measurements when attempting to correlate ear characteristics to foraging ecology. We hypothesize that the size of the tragus will differ across various feeding guilds, foraging habitats, and foraging styles. In order to explore these relationships, the Auto Montage system, a new method for high resolution measurement of mammal morphology, was used to measure the surface areas of the tragus and pinna apertures. These surface area measurements were then made into a tragus : pinna ratio for use in analyses. Fourteen species in five subfamilies (Carollinae, Desmodontinae, Glossophaginae, Phyllostominae and Stenodermatinae) and six feeding guilds (carnivory, frugivory, insectivory, nectarivory, omnivory and sanguinivory) were included in this study.

80 THREE SPECIES OF THE PEROMYSCUS MEXICANUS GROUP: CONGRUENCE BETWEEN MORPHOLOGICAL AND MOLECULAR DATA

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Members of the Peromyscus mexicanus group are common to abundant in many habitats throughout Middle America. Current taxonomy recognizes seven species in this species group; however, the conspecific status of allopatric populations and the species limits of several of its members have been called into question by several authorities. Thus, the objective of this work is to provide the basis for the delimitation of species limits among three members of the Peromyscus mexicanus group, namely Peromyscus grandis, P. guatemalensis, and P. zarhynchus. Our approach is two-fold as we use multivariate analyses of morphometric measurements supplemented by the analysis of mtDNA sequence data for representative specimens. To complement Museum holdings, special efforts were placed in collecting topotypical specimens of P. grandis and P. guatemalensis which were later compared to animals from their respective type series. Multivariate analyses of 18 craniodental measurement in 342 animals from 25 localities from southern Mexico to central Guatemala were used to investigate intra and inter species patterns of variation: we found no sexual dimorphism in any of
the three species, and only slight morphometric variation explained solely by geography. Conversely, the three species are clearly identified as morphologic units using a size-free DFA. A phenogram constructed with UPGMA, based on Mahalanobis distance showed that P. grandis and P. guatemalensis were more similar to each other in contrast with the hypothesis proposed by D. Huckaby in the early 1980s. Interestingly these forms occupy very similar environment but in allopatric locations. Our analysis of mtDNA sequence data for topotypical specimens - in the context of a phylogeny of the species group - appears to support the hypothesis that each of these units represents a distinct evolutionary lineage.

81 LONGITUDINAL STUDY OF INDIVIDUALLY MARKED SHORT-TAILED SHREWS (BLARINA BREVICAUDA)

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Basic demographic observations of short-tailed shrew populations have been thwarted by their fossorial habit, high trap mortality and difficulties in marking individuals. By marking individuals with subcutaneous PIT tags and making frequent trap checks, we were able to reduce trap mortality to 3% and trap 62 individuals a total of 263 times (maximum captures/individual = 14). Individuals were trapped at Rice Creek Field Station, Oswego, New York, using Sherman live traps every 1 to 2 weeks from June-October 2007, but only opportunistically during the winter to avoid trap mortality due to cold. Weight and reproductive condition varied too much to provide reliable estimates of age of individuals, but field measurements of incisors were reasonably consistent over shorter periods with measurable tooth wear over longer intervals of time, allowing us to place individuals into 3 age classes. Younger animals replaced older ones over the summer months as young were born and matured and older animals died. Females bred at all ages, but older males were significantly more often reproductively active than younger males, suggesting a highly polygynous mating system.

82 GEOMETRIC CRANIAL MORPHOMETRIC ANALYSIS OF NON-GEOGRAPHIC VARIATION: A CASE STUDY BASED ON TWO GEOGRAPHICALLY DISPARATE SPECIES, AETHOMYS INEPTUS FROM SOUTHERN AFRICA AND ARVICANTHIS NILOTICUS FROM SUDAN (RODENTIA: MURIDAE)

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Non-geographic morphometric variation, particularly at the level of sexual dimorphism and age variation, has been documented in rodents, and is useful for establishing whether to analyse sexes separately or together, and for selecting adult specimens for subsequent data recording and analysis. However, such studies have largely been based on traditional morphometric analyses of linear measurements that mainly focus on overall size, rather than shape-related morpholometric variation. Unit-free, landmark/outline-based geometric morphometric analyses are considered to offer a more appropriate tool for assessing shape-related morpholometric variation. In this study, we used geometric cranial morphometric analysis to assess the nature and extent of sexual dimorphism and age variation within the Tete veld rat, Aethomys ineptus (Thomas and Wroughton, 1908) from southern Africa and the African Nile rat, Arvicanthis niloticus (Demarset, 1842) from Sudan. The results obtained were in turn compared with previously published results based on independent traditional cranial morphometric data from the same sampled populations examined in the present study. While our geometric morphometric results within both species detected statistically significant ($P < 0.05$) sexual dimorphism in cranial shape within A. niloticus only, previously published results
based on traditional morphometric data concluded on the lack of sexual dimorphism within this species. However, similar to previously published traditional morphometric data, our geometric morphometric results detected statistically significant ($P < 0.05$) age-related variation in cranial shape and size within both $A. ineptus$ and $A. niloticus$ ($P < 0.05$), with individuals of age classes 5 and 6 being considered to represent adult specimens. Our results highlight the importance of carefully evaluating both size- and shape-related non-geographic morphometric variation prior to the analysis of geographic variation and the delineation of species. Erroneous conclusions of non-geographic variation may have implications in the interpretation of geographic and evolutionary processes that may be responsible for morphological differences at both the inter- and intra-specific levels.

83 ARE THERE INDIVIDUAL AND/OR ROOST SIGNATURES IN THE ECHOLOCATION CALLS OF WILD BIG BROWN BATS ($EPTESICUS FUSCUS$)?

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Unique individual vocal signatures are widespread among animals living in colonies such as the maternity roosts of $Eptesicus fuscus$. Such individual signatures have been identified in the echolocation calls of $E. fuscus$ in the laboratory, but have not been demonstrated in the wild. By recording known wild $E. fuscus$ as they emerged from their roosts at dusk, I tested the hypothesis that individual and/or roost signatures exist in the echolocation calls of wild $E. fuscus$. Analyses of calls of 176 individuals recorded at six different locations indicate that temporal and spectral features appear to contain sufficient variation to identify both roost and individual vocal signatures. Overall, bats were correctly associated with their roosts 48%, and with individual identity 14-37%, of the time. The incidence of such signatures may be significant to wild $E. fuscus$ population dynamics.

84 ENVIRONMENTAL CORRELATES OF SURVIVAL AND REPRODUCTION IN OLD-FIELD RODENTS

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The population dynamics of many species are affected by environmental variation. However, many of the relationships between a population and the environment are complex, involving interactions among environmental correlates. We had previously analyzed a dataset for relationships between survival and the environment in two species—the hispid cotton rat ($Sigmodon hispidus$) and the prairie vole ($Microtus ochrogaster$)—and found no significant correlations. We used regression trees to assess seasonal relationships in vital rates (survival and reproduction) to a suite of environmental variables. We found only two relationships between vital rates and environmental correlates in $M. ochrogaster$; whereas, we found multiple relationships in all seasons in $S. hispidus$. The majority of recovered regression trees contained multiple variables, indicating that the vital rates of $S. hispidus$ were affected by interactions among environmental correlates. The vital rates of $S. hispidus$ were most affected by precipitation, temperature, and snowfall; however, the direction of the effect of these environmental variables was not consistent among seasons. For example, snowfall in autumn negatively affected reproduction whereas snowfall in winter increased apparent survival. Our analyses indicate that $M. ochrogaster$ populations in northeast Kansas are relatively insensitive to environmental variability while survival and reproduction in $S. hispidus$ is influenced by the environment throughout the year. Relationships between mammals and the environment may be too complex to determine
from linear analyses and the response to environmental conditions in one season may not predict the response to the same environmental variable in other seasons.

85 SMALL MAMMAL RESPONSE TO VARYING AMOUNTS OF WOODY VEGETATION IN SHORTGRASS PRAIRIE

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Conversion of grasslands to row crop agriculture and other uses has drastically reduced the extent of shortgrass prairie in North America and especially in Texas. Much of the remaining prairie has been degraded by invasion of woody vegetation. We examined the influence of cover of woody vegetation on small mammals by sampling 9 sites that varied in cover of woody vegetation in the panhandle of Texas. Sherman live traps were set out in a 10 X 10 trap grid (10 m spacing) at each of 9 sites. Traps were run for a minimum of 3 consecutive nights in each grid and each grid was sampled during two sessions (June and December 2007). We measured the cover of woody vegetation at each grid using the line intercept method. We captured 351 individuals of 9 species during 6,300 trap nights. Abundance varied greatly between the two sessions with 66 individuals captured during session 1 and 285 individuals captured during session 2. Biomass of small mammals was positively related to cover of woody vegetation during both sessions. Abundance of small mammals was strongly and positively related to the cover of woody vegetation during session 2 but no relationship was found during session 1. Similarly, abundance of Baiomys taylori, Reithrodontomys montanus and R. megalotis (not captured during session 1) were positively related to cover of woody vegetation during session 2 but not session 1. Abundance of Sigmodon hispidus increased with increasing cover of woody vegetation during both sessions. Neotoma micropus was most abundant at sites with intermediate cover of woody vegetation during both sessions. Our preliminary results indicate that small mammals exhibit little response to woody vegetation when abundances are low but abundance and biomass of small mammals increases with increasing cover of woody vegetation when abundances are high.

86 SEX-SPECIFIC RESPONSES OF NORTH AMERICAN ELK TO FUELS REDUCTION

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Sexual segregation outside the mating season is nearly ubiquitous among polygynous cervids, and can be influenced by differential selection of forage by the sexes. A powerful approach to testing hypotheses about the relationship between selection of foraging habitat and sexual segregation is to evaluate sex-specific responses to experimental manipulation of habitat. Few studies, however, have considered the potential for habitat manipulation to affect female and male cervids in different ways. We evaluated responses of female and male North American elk (Cervus elaphus) to an experimental fuels reduction program at the Starkey Experimental Forest and Range (Starkey) in northeastern Oregon, USA. From 2001 to 2003, 26 stands of true fir (Abies spp.) and Douglas-fir (Pseudotsuga menziesii) were mechanically thinned and burned, whereas 27 similar stands were left untreated to serve as controls. We used locations from 48 females and 14 males collected during spring and summer of 2005 and 2006 to compare seasonal patterns of habitat use between sexes. During spring, females selected 4-year-old burns and used 2 and 3-year-old burns in proportion to their availability, whereas males avoided all fire-treated stands. In addition, control stands were avoided by females but selected by males during spring. During summer, control stands were selected and treatment stands either were avoided or used in proportion to their availability by the sexes. Use of treated stands by female and male elk was influenced by different environmental variables across seasons, but mean overlap of utilization distributions (UDs) between the sexes was higher in summer than spring. These results indicate that although
fuels reduction treatments at Starkey may have increased foraging opportunities for female elk in spring, those treatments likely were of little benefit to male elk.

87 INFLUENCE OF SAMPLING INTENSITY AND LANDSCAPE VARIABLES ON PROBABILITY OF SITE OCCUPANCY OF EASTERN FOX SQUIRRELS

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We estimated site occupancy rates and probabilities of detection for eastern fox squirrel (Sciurus niger), eastern gray squirrel (Sciurus carolinensis), Virginia opossum (Didelphis virginiana), raccoon (Procyon lotor), swamp rabbit (Sylvilagus aquaticus) and white-tailed deer (Odocoileus virginianus) as a function of sampling intensity and landscape variables. During the summer of 2007 and winter of 2008, 9 camera station grids were deployed for 10-day sessions at 8 different study sites. Each individual camera station was baited daily with approximately 1 ½ ears of corn (300g), ¼ of an apple (25g), and 100g of alfalfa pellets and consisted of two infrared remote camera sensors (LeafRiver model DC-6SS) aimed at each bait pile from distances of 5 - 7 meters away. At each study site, 9 camera stations were deployed in grids with approximately 100 meters between each adjacent station covering an area of roughly 9 ha. The 8 study sites were located within bottomland hardwood forests in southwestern Indiana and northern Kentucky, USA. At each study site, we estimated the following landscape variables: size of the bottomland forest patch, indices of patch shape and isolation. We developed occupancy models for each of the mammalian species using detection histories to estimate patch occupancy rates as a function of landscape variables and sampling intensity. We report on the relative contribution of different indices of landscape context and different intensities of sampling, such as the number of cameras and duration of deployment.

88 SHIFTING FAUNAL COMPOSITION UNDER WOODY ENCOREACHMENT: EQUILIBRIUM AND NON-EQUILIBRIUM PERSPECTIVES

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Woody encroachment is a worldwide phenomenon having important consequences for grassland and savanna ecosystems and has been described within contrasting equilibrium and non-equilibrium paradigms. Alteration of historical disturbance regimes has led to rapid encroachment by eastern redcedar (Juniperus virginiana), a native coniferous tree, in grasslands of the Great Plains of North America. We examined the effects of woody encroachment and vegetation patterns on composition of small-mammal assemblages at 16 mixed-grass prairie sites along a gradient of increasing cover of redcedar. In addition, we examined the role of disturbances in modifying faunal responses to encroachment. Small-mammal abundance, species diversity and species evenness were all highest at intermediate levels of woody cover. These trends were equilibrial responses related to the degree of grassland/woodland interdigitation and variable dominance of two species of Peromyscus at the extremes of the gradient. Small-mammal abundance also was influenced by within-site spatial variability of both herbaceous and woody cover. However, we noted that sites having similar levels of woody encroachment exhibited different faunal attributes. These variable responses appear linked to stochastic disturbances that modulated the consequences of woody encroachment for associated fauna and were consistent with non-equilibrium concepts. Thus, the effects of redcedar encroachment on this faunal assemblage may be most effectively described by a combination of equilibrial responses to redcedar canopy cover and non-equilibrium responses driven by stochastic events. Understanding the application of both
perspectives will be important for designing effective management strategies to restore and conserve these imperiled ecosystems.

89 HABITAT AFFINITIES OF SMALL MAMMALS ON THE NIOBRARA CHALK BARRENS AT FORT CARSON, COLORADO

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We examined the habitat affinities of 705 small mammals at multiple scales on the Niobrara Chalk Barren (NCB) outcrops at Fort Carson, Colorado from fall 2006 to fall 2007. The NCB outcrops on Fort Carson lie within the piñon-juniper woodland community, and are divided into the Great Plains and the Rocky Mountain Provinces. We had no captures of deer mice (Peromyscus maniculatus), silky pocket mice (Perognathus flavus), brush mice (Peromyscus boylii), and white-footed mice (Peromyscus leucopus) in 2006, however, all were present in 2007. Of the three species present in our plots in 2006 and 2007, Colorado chipmunks (Tamias quadrivittatus), piñon mice (Peromyscus truei), and Mexican woodrats (Neotoma mexicana), we had a neutral, 31.8% increase, and 50% decrease in abundance respectively. Although we found significant differences (P<0.05) in percents of cover types, there was no significant difference (P>0.05) in small mammal biodiversity between the two provinces or nearest vegetative community type. However, P. maniculatus, P. truei, and P. leucopus were more abundant in the Great Plains Province than in the Rocky Mountain Province. At the microhabitat scale, P. truei used juniper 12.5% more and bare ground 9% less than P. maniculatus. We found P. leucopus using tumbleweeds (Salsola kali) 21% of the time, and observed P. truei climbing and using cavities in one-seeded juniper more than other sympatric species. We conclude that the assemblages of small mammals may be influenced by seasons and with proximity to floristic changes at the physiographic, community, and microhabitat scales. Long-term surveys are needed to evaluate which environmental factors affect annual population fluctuations in small mammal on the NCB at Fort Carson.

90 LANDSCAPE ECOLOGY OF CAPYBARA (HYDROCHAERIS HYDROCHAERIS) IN THE CHACO REGION OF PARAGUAY.

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Capybara is the largest rodent in the world, is widely distributed throughout most of South and Central America, and inhabits a great variety of habitats. Although considered a common species in most of its range, little is known about the factors affecting its distribution and population connectivity in the Gran Chaco of Paraguay. Understand the effects of anthropogenic land fragmentation, land use, and habitat quality on population connectivity is essential for effective management of this species. I used a three-pronged approach to investigate the landscape ecology of capybara in the Chaco Region of Paraguay. First, I surveyed for sign of capybara in the Chaco to determine suitable habitat for the species. Second, I used a non-invasive genetic approach to determine connectivity among major population centers of the species. Third, I selected an intensely fragmented area in the central Chaco to conduct a fine-scale study of habitat use, using radio-telemetry. Currently, I have created a dry season distribution map for the species by analyzing multiple biogeophysical factors. In a preliminary analysis, year round water sources, including rivers and reservoirs appear critical for presence of capybara during the dry season. Mitochondria D-loop data suggest that three distinct clades of capybara persist in the Chaco. Telemetry results highlight the importance of the presence of year round water more than any other factor. The genetic data strongly support the hypothesis that the distribution of water during the dry season greatly influences connectivity of populations across the landscape.
Year-round water is a limiting factor for capybara presence which has also shaped the genetic characteristics of these populations. These data will allow me to predict important pathways of connectivity among populations and greatly help for an effective management plan for the species in the region.

91 THE HISTORY OF HUMAN DIVERSITY IN AMERICAN MAMMALOGY: HOW HAVE WE CHANGED AND WHAT IS OUR FUTURE?

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In the nearly 90 years from its founding in 1919 until now, the American Society of Mammalogists (ASM) has seen major changes related to human diversity. At its inception, the ASM claimed an almost exclusively male, Caucasian membership largely of European descent; fewer than 4% of the original charter members were female. For the next four decades, women formed a relatively small but stable proportion of ASM activities, representing <10% annually of (1) ASM membership, (2) ASM meeting presentations, and (3) Journal of Mammalogy publications. The latter half of the 20th century, however, saw some increases in the participation of women in the ASM, but little change in the relatively low participation of racial and/or ethnic minorities. In 1992, the governance of ASM established an ad hoc Committee on Women and Minority Issues; after transitioning to the ad hoc Committee on Human Diversity in Mammalogy (to reflect a broader mission), the Human Diversity Committee (HDC) was elevated to a full-fledged standing committee in 1998. The HDC mission is to support and facilitate the following goal: "The American Society of Mammalogists is committed to encouraging the active participation by all members, regardless of gender, race, ethnic background, age, physical disabilities, or sexual preference."

The HDC has worked to (1) highlight diversity issues, (2) sponsor diversity-related activities, (3) monitor ASM diversity and participation, and (4) examine strategies to broaden ASM diversity. The last decade has seen continued increases in female participation in the ASM, including a larger role in governance of the Society; however, ethnic/racial minority participation has remained relatively limited, and recruitment and retention continue to be focal issues. As the ASM approaches the end of its first century as a professional society, what are our collective goals for increasing the diversity of and participation in the ASM and how will we achieve these?

92 HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: HUMAN DIVERSITY IN SOUTH DAKOTA

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European immigration to South Dakota produced a current population that is predominately Caucasian of German, Norwegian, Irish, English, and Dutch ancestry. The Native American population is estimated at over 10% and residents of Black, Asian, and Hispanic ancestry combine comprise less than 4% of the population. The Native American population retains a vibrant independent culture on nine American Indian Reservations in the state. Of the 11,500 students at South Dakota State University, approximately 180 are Native American. The limited representation of Native American students at SDSU is due to social, cultural, historical, and geographical reasons. Efforts are being made to facilitate enrollment of Native Americans and other underrepresented populations. Relationships with tribal colleges have been developed as part of this endeavor. Diversity is recognized as a “compelling interest” for the university as an educational institution, but also as an important reflection of social equity within the state. Given the underrepresentation of a large portion of the state’s population, and the historic separation of societies, educational programming for students and staff regarding Native American culture is also a university priority along with Native American recruitment.
93 HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: INDIGENOUS DIVERSITY OF THE NORTHERN PLAINS

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The northern plains of the United States is home for a variety of indigenous peoples with unique cultures, languages, and histories. The Lakota, Dakota, and Nakota speaking closely related Siouan languages, have nine reservations in South Dakota. Also known as the Sioux, their culture and customs remain separate from the mainstream European society for historical and social reasons. The Missouri River valley in central South Dakota is the ancestral home of the Mandan and Hidatsa who speak Siouan languages. Their societies were originally agriculturally based, with permanent homes in cities sometimes of several thousand residents. Trade occurred with tribes throughout the North American continent. Today their land is part of the reservation for the Three Affiliated Tribes and is located in North Dakota. The Arikara, speaking a Caldoan language, are the third tribe sharing the reservation. Programs for the development of human and economic potential for Native Americans are an important part of the mission for South Dakota State University.

94 A COLLABORATIVE EFFORT AND A PIPELINE APPROACH TO INCREASING RETENTION OF UNDERREPRESENTED MINORITIES IN THE SCIENCES

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For three years, Beloit College and the University of Wisconsin at Whitewater have collaborated to provide research and learning opportunities for students from underrepresented minority (URM) groups in STEM (Science Technology Engineering and Mathematics) majors. To help ensure that our students successfully matriculate and emerge with a first rate summer research experiences, we have created programs to fund URM students to conduct research that will make them more competitive for graduate school and post-baccalaureate careers in STEM fields. Our programs are externally funded and we support research both during the summer and academic year. We have created a regional initiative to engage URM students in part-time paid research assistantships in their STEM majors or anticipated majors as well as a research experience for undergraduates program that funds 10 weeks of summer research. Both institutions have committed to a pipeline approach to the recruitment of underrepresented students to our institutions with pre-collegiate programs (Federal Talent Search) and college programs (Ronald E. McNair Post-Baccalaureate Achievement Program). Through institutional collaboration and a pipeline approach to recruitment of students, we believe that we represent a successful model for the recruitment and retention of underrepresented minority students into the sciences.

95 ENVIRONMENTAL INFLUENCES ON THE HIBERNATION PATTERNS OF EASTERN WOODCHUCKS

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Animals enter hibernation to cope with low environmental temperatures and lack of food resources. However, we know little about the flexibility of hibernation physiology, i.e., how differences in environmental conditions affect hibernation patterns within a species. Woodchucks (*Marmota monax*) occupy a wide geographic range, thus experience a wide range of ecological conditions. We would expect these mammals to vary in hibernation patterns depending on latitude. We collected body core temperatures (Tb) on a continuous basis from free-ranging woodchucks during 3 hibernation seasons from fall 2005 to spring 2008 at field locations in Maine (43°42’N; 70°14’W), Pennsylvania (40°22’N; 75°22’W), and South Carolina (33°26’N; 81°20’W). We surgically implanted iButton temperature data loggers into animals from each location (11 in ME, 12 in PA, 8 in SC). We released them at the site of capture and recaptured them at the end of each hibernation season to recover the loggers. During the winter of 2007-08, two animals from each location were captured and maintained in the lab under constant temperature conditions. In the field, average length of the hibernation season differed significantly among the 3 locations: 175 days in ME, 102 days in PA, and 67 days in SC. In ME, animals spent 88% of the time in torpor; in PA 80%; and in SC 70%. Dates of first torpor and final arousal, number of torpor bouts, length of torpor and euthermic bouts, and torpor Tb’s also differed significantly across populations. Lab animals from the 3 locations exhibited no significant differences in their hibernation patterns. These results reflect the flexibility of hibernation under different environmental conditions and the relative influence of environmental versus genetic factors on hibernation patterns.

96 EFFECTS OF HUMAN RESOURCES ON *NEOTOMA MICROPUS*.

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*Neotoma micropus*, living in close proximity to human populations have greater mass, body fat, bone density, and red blood cell counts than populations that cannot access human-produced resources. Given these responses to the proximity of human generated resources, we wished to investigate the response of *N. micropus* to a standard Western human diet. Results of our study show that when *N. micropus* is placed on a high fat, high carbohydrate diet, they rapidly develop an increase in blood glucose levels, develop fatty deposits in the liver similar to non-alcoholic fatty liver disease, and glomerular swelling which results in a decrease in the Bowman’s space. Our results suggest that *N. micropus* experience negative effects of the consumption of a Western diet. The next step in our research will be to assess effects of populations living in proximity to human populations and compare them to populations that cannot access human-generated resources.

97 MECHANISMS OF NITROGEN CONSERVATION IN A SMALL MAMMAL HIBERNATOR DURING PERIODS OF PROTEIN RESTRICTION AND TORPOR

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Mammalian hibernators employ unique behavioral and physiological mechanisms which allow them to survive 4-5 months of fasting and relative immobility. Integral to long-term adapted fasting is an enhanced ability to conserve tissue protein. My thesis research investigated the mechanisms which are hypothesized to work to increase the efficiency of nitrogen conservation through urea nitrogen recycling in a small mammal hibernator, the Wyoming ground squirrel (*Spermophilus elegans*). Specifically, squirrels under varying conditions of protein restriction and torpor were monitored for: (1) the presence and abundance of urea transporters (UTBs) in bladder and lower GI tract tissues responsible for scavenging body urea, (2) intestinal microbial urease
activity responsible for hydrolyzing urea, and (3) the contribution of urea derived nitrogen to body tissues. We have identified the previously unconfirmed presence of urea transporters (UT-Bs) in the bladder and intestinal tissues of a mammalian hibernator, indicating a facilitated pathway for urea-Bs recycling. Moreover, we found significantly greater urea nitrogen incorporation into tissues of squirrels experiencing protein deficiencies than those in protein excess, suggesting that protein stressed animals have the capacity to enhance their ability to retain, hydrolyze, and incorporate urea nitrogen. However, there were no significant differences in urease activity in the digesta of squirrels fed low protein, standard protein, or high protein diets or squirrels undergoing hibernation. Therefore regulation of nitrogen recycling may not be a function of urea hydrolysis but rather alterations in the capacity to transport urea.

98 CRANIAL BIOMECHANICS OF THE SPOTTED HYENA *CROcuta CROcuta* AND EVIDENCE FOR STRUCTURAL CONVERGENCE IN BONE-CRACKING CAPABILITY IN THE SKULL OF THE EXTINCT GIANT PERCROCUTID *DINOcrocuta GIGantea*

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The spotted hyenas are unique among large carnivores in their ability to crack open and consume large prey bones. In addition to massive jaw musculature, adaptations in the enamel microstructure of their dentition, their hypertrophied third premolars, and the unique frontal sinus 2° in the dorsal cranium provide biomechanical advantage in their masticatory apparatus for durophagy. The bone-cracking ecomorphology represented by hyaenids today evolved repeatedly throughout the Cenozoic, including extinct lineages of canids, creodonts, and the feliform percrocutids. Among the fossil and living species to show craniodental morphology indicative of bone-cracking capability, the percrocutid *Dinocrocuta gigantea* is one of the largest, with a total skull length of over 350 mm. To test the extent that the skull of *Dinocrocuta* is “hyena-like” in its capability to distribute and dissipate cranial stress during a bone-cracking bite using the highly robust third premolar, finite element models of the skulls of *Dinocrocuta gigantea* and the spotted hyena *Crocuta crocuta* were constructed and compared to the meat specialist *Canis lupus* in a biomechanical analysis. Findings indicate that the crania of *D. gigantea* and *C. crocuta* perform better in stress distribution and dissipation than that of *C. lupus*, regardless of P3 or P4 biting. More specifically, the vaulted fronto-parietal region of *D. gigantea* and *C. crocuta* received lower, as well as more evenly distributed stress than *C. lupus*. Thus, the craniodental structures of the two feliform carnivores are linked by functional advantage over that of *C. lupus* for bone-cracking, and this capability evolved separately from less durophagous forms in the two families. These findings provide support for using craniodental morphology as indicators of functional capability, and demonstrate the utility of this biomechanical testing method in elucidating the possible ecological roles of extinct mammalian carnivores.

99 THERMOREGULATORY ADVANTAGES OF SHADE USE BY DESERT BIGHORN SHEEP

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Ungulates in arid climates use a variety of mechanisms to cope with environmental conditions that can result in heat stress and dehydration. Use of shade during midday is common among desert ungulates of the southwestern United States. Desert bighorn sheep (*Ovis canadensis mexicana*) use both vegetation and caves as sources of thermal cover. We assessed potential thermoregulatory advantages of the use of vegetation and caves by desert bighorn sheep on the Cabeza Prieta National Wildlife Refuge, Arizona. Midday ambient temperatures in caves were an average of 6.9 °C (SE = 0.344)
lower than control sites; ambient temperature under tree canopies was an average of 3.3 °C (SE = 0.950) below control sites. Caves provided higher quality shade than tree canopies; midday temperature in caves was an average of 3.4 °C (SE = 1.06) lower than under tree canopies. Potential thermal benefits of both caves and tree canopies increased with increasing daily high temperature. Behavioral adaptations function in combination with physiological and morphological mechanisms and are of critical importance for the maintenance of temperature and water balance. Short-term physiological and ecological performance is influenced by habitat selection and use of microhabitat; abiotic factors (e.g., ambient temperature) can ultimately influence animal fitness and the demography of animal populations.

100 USING STABLE CARBON AND NITROGEN ISOTOPES TO INFER SEASONAL DIETARY CHANGES AND NICHE SEPARATION BETWEEN DEER MICE AND WHITE-FOOTED MICE IN SOUTHEASTERN SOUTH DAKOTA

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Two species of Peromyscus mice, the white-footed mouse (Peromyscus leucopus) and the deer mouse (Peromyscus maniculatus), occur sympatriically throughout much of eastern North America. Niche separation is thought to occur along three primary axes: (1) spatial segregation (including differential use of habitat); (2) temporal avoidance; and/or (3) dietary differences. Several studies have investigated spatial separation and temporal avoidance as possible key mechanisms for niche differentiation between the white footed mice and deer mice. But because of the limitations associated with using traditional dietary analysis techniques, few studies have been able to detect seasonal dietary shifts between these two species or to identify differing microhabitat sources of similar food items. Recently, this work has been facilitated by stable isotope analysis (SIA) of carbon and nitrogen. In this study, we sought to determine how deer mice and white-footed mouse use and partition food resources within the agriculturally dominated landscape of southeastern South Dakota. By analyzing the stable carbon and nitrogen isotopes of hair samples from the same individuals over a two-year period, we were able to track yearly and seasonal dietary changes. Our results indicate that deer mice obtain most of their food directly from agricultural fields while white-footed mice feed primarily in woodland and grassland areas surrounding agricultural fields. These data were strengthened with trapping data indicating microhabitat preference for cropland in deer mice versus woodlands for white-footed mice. This study demonstrates how SIA can be a useful tool for investigating niche separation between sympatric species as well as providing detailed information on seasonal changes in food habits over time.

101 TRAPPING STUDY OF THE ENDANGERED KEY LARGO COTTON MOUSE: A METHOD FOR LONG-TERM POPULATION MONITORING

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The Key Largo cotton mouse (Peromyscus gossypinus allapaticola) is an endemic, insular subspecies of the cotton mouse (P. gossypinus) found only on Key Largo, Florida. The Key Largo cotton mouse was listed as endangered in 1984, primarily in response to habitat loss and fragmentation from development. Although Key Largo cotton mouse populations appear relatively stable in suitable habitat, the current population status is unknown. The most recent quantitative density estimate for the Key Largo cotton mouse in 1988 was 21.2 individuals/ha across all habitats (851 ha). Previous estimates used large grids, long trapping periods, and high capture probabilities. Obtaining such data at a large scale is practically impossible for routine population
monitoring due to limitations in budgets and personnel. The goal of this study was to develop a standardized methodology for reliably assessing Key Largo cotton mouse population trends given the economic and personnel constraints of the agencies conducting the field work. To achieve this goal, we evaluated a sampling method that has potential to provide reliable and efficient monitoring of long-term trends in Key Largo cotton mouse populations. We live-trapped on 33 grids 3 times each in 2007 using a 7 x 7 grid arrangement over 4 consecutive nights. We collected 557 individuals with 1538 total captures; a 2:1M:F ratio. Population abundance was estimated using capture data from the 3 sessions using Pollack's Robust Design. Analysis included using Program Mark to determine to most efficient combination of trapping grids and trapping effort for future population estimation.

102 DEMYSTIFYING THE RARITY OF THE ONLY EXTANT GONDWANIAN MICROBIOTHERID, THE MOUSE OPOSSUM

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The mouse opossum (Dromiciops gliroides Thomas) is an arboreal marsupial endemic of the South American temperate rainforest that has a high conservation value due to its phylogenetic unicity, and is considered endangered because of human impacts and its rarity. Previous abundance assessments of D. gliroides are usually very low. We tested the hypothesis that the scarcity reported depends on the traditional trapping methods used. We used a completely randomized design of 4 trapping or recording methods, 2 heights, and two baits, employing six trap lines of 32 stations each, for 6 days in a rainforest in southern Chile. The different trap-height-bait combinations showed a clear species-specific trapping pattern: D. gliroides was caught mainly in wire-mesh traps with banana when above the ground and little in other combinations. In contrast, mice were caught mainly on Sherman traps with oats on the ground. Similar results were provided by hair and track traps in regard to bait and height. Later we compared these results with a wire-mesh trap grid, placed off the ground and with banana to maximize the capture of D. gliroides, resulting in a more than 10% of efficiency in capturing the marsupial. This supports our hypothesis that previous estimates of D. gliroides abundances were negatively biased due to the method used. The species appear not to be rare in the temperate rainforest when properly sampled.

103 INVESTIGATING POPULATION STRUCTURE AND PHILOPATRY IN RINGED SEALS (PHOCA HISPIDA)

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Effective management of the ringed seal (Phoca hispida), an arctic species heavily exploited for subsistence and threatened by climate change, requires understanding population structure. Ringed seals are currently classified as a panmictic population; however, increasing evidence of site fidelity during the breeding season suggests philopatry, and genetically differentiated populations. Recognizing population structure becomes important when considering the rapid climate change in the Polar Regions. If ringed seals are a panmictic population, then climate change will reduce their range but with minimal genetic loss. Genetic diversity is important to the population's ability to respond to threats such as climate change. If ringed seals exhibit limited breeding dispersal, they will exhibit multiple populations and be more susceptible to genetic loss. However, if ringed seals are philopatric, they will exist in numerous discrete populations; climate change will increase the probability of local extirpations and genetic loss. Two hundred and fifty-five samples were collected from ringed seals or the ice at several sites in the Beaufort, Chukchi, and Baltic Seas. F-st values were low between all Arctic sites, however the Baltic Sea population exhibited slightly higher levels of unique
variation compared to Canadian, and Alaskan samples (Fst- 0.034; 0.040 respectively). STRUCTURE and GENELAND found the most likely number of populations to be one. Assignment tests however, do not support the conclusion based on all but 3 individuals being assigned to the population of capture. Further research, and more sample locations are necessary to determine if ringed seals have further population structuring during the breeding season.

104 EXAMINING RELATIONSHIPS BETWEEN HABITAT HETEROGENEITY AND SPECIES RICHNESS OF SMALL MAMMALS

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The habitat heterogeneity hypothesis states that increases in habitat heterogeneity positively influences species richness however, this hypothesis has been infrequently tested across spatial scales. The prediction that habitat heterogeneity and species richness are associated was tested with small mammals at three spatial scales (point, local, and regional) in the tropical dry-forest region of Colima, Mexico. This location, within the Mesoamerican biodiversity hotspot, was sampled during winters of 2003-2008. Sampling was conducted (in total) on 30 trapping grids (each grid station with an arboreal and ground-level trap) using a 10m × 10m design at each level, which resulted in 200 traps per grid. Grids were trapped 7 nights during each sampling period. In total, there were 42,000 trap-nights (1 trap-night = 1 trap set for 1 night). Species richness at each spatial scale was examined in relation to 14 habitat variables, representing vertical and horizontal structural components, taken at each trap site. Results confirmed a minimum of 22 species within the region studied. Data were examined using correlation and regression analyses. Species richness was associated with select vertical and horizontal habitat features, but these varied with scale. Our results demonstrate that spatial scale is a factor in understanding habitat heterogeneity and species richness associations.

105 UNDERSTANDING FLUCTUATIONS IN BOBCAT HARVEST AT THE NORTHERN LIMIT OF THEIR RANGE

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Population densities of many animal species have substantially increased during the last decades because of climate warming and new agricultural and forest practices. In Québec, however, the bobcat (Lynx rufus) is one of the rare southern species that remains scarce. Curiously, other northern populations of bobcat are stable and exploited in the provinces and States neighbouring Québec. In Québec, the hunting and trapping of bobcat have been closed since 1991. Currently, managers ignore the status of populations and how to protect this species since the animals harvested were their main source of information. To acquire a better picture of the health of bobcat populations of Québec, we

106 AN INTRODUCED POPULATION OF MEXICAN RED-BELLIED SQUIRRELS IN BISCUAYNE NATIONAL PARK, FLORIDA, USA

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Invasive species are a primary contributor to the loss of native species biodiversity worldwide, and their impacts continue to increase. Mammalian invaders threaten native species with predation, competition, and disease. We focused on an introduced population of Mexican red-bellied squirrels (Sciurus aureogaster) in Biscayne National Park, Florida, USA, to explore the ways non-native tree squirrels may impact native biodiversity on Elliott Key. We initiated a project to assess the current status, distribution, and impact of red-bellied squirrels in the Park. From 2006 to 2007, we found over 200 squirrel nests in the mixed-hardwood forest on Elliott Key, and examined nest sites to determine what forest structural characteristics are preferred in nest-site selection. In addition to the population on Elliott, we also documented squirrels on two other islands, which provides evidence for the spread of this non-native species within Biscayne National Park. Our study provided information that was incorporated by park managers into a management plan for this invasive species. We will discuss the details of this plan as well as the impacts the population has on the native ecosystem.

107 LIFE IN THE URBAN MATRIX: DEMOGRAPHIC PATTERNS OF RACCOONS IN THE CHICAGO METROPOLITAN AREA.

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Much of our knowledge of urban raccoons (Procyon lotor) comes from studies in urban parks or suburban areas, in which raccoon populations can attain high densities. However, relatively little is known regarding how raccoon population characteristics may change as one moves from protected fragments into the urban matrix. Knowledge regarding raccoon population biology in urban areas is vital given the potential impacts that rabies and other diseases can have on the health and safety of humans and domestic species. Although highly urbanized, nearly 11% of Cook County is a mosaic of forest preserves, making it an ideal area to research how habitat and land use patterns influence raccoon population biology. To determine the relationships between urban land use, and raccoon population demographics, we sampled 18 sites across the Chicago metro area during 2005-2006 in the spring and summer. Eight sites were primarily urban open space, 6 sites were urbanized areas composed mainly of residential areas, 1 site was dominated by industrial land use, and 3 sites were forested rural open spaces. We predicted that raccoon abundance would increase with urbanization, that urban open areas and rural open areas would have a sex ratio of 1:1 (M:F), and that the sex ratios in highly urbanized areas would be male-biased. We also predicted that urban and rural open sites would have an older age structure than the urbanized sites. We compared density estimates, sex ratios and age structure from these areas. We captured 530 adult raccoons during 3,476 trapnights. Densities (raccoons/km2) were highest in urban open areas (range: 3.0-28.0), followed by rural open areas (range: 13.0-20.0), and residential areas (range: 1.0-10.0). Overall urban open sites had sex ratios of 1.02:1, urbanized sites had 0.96:1 and rural open spaces had 2.06:1. Highly urbanized sites lacked raccoons of the oldest age class. We found that urbanization influences raccoon abundance and other demographic parameters.
The Abert's squirrel (Sciurus aberti) is a common sciurid occurring in pine forests in western North America. In the 1940's, S. aberti was deliberately transplanted outside historical range in northern Arizona to increase hunting opportunities. Translocations resulted in introduced populations of S. aberti that persist in many of the "sky islands" of southeastern Arizona. In the Pinaleno (Graham) Mountains, S. aberti inhabits high elevation mixed conifer forests where it may compete with the native endangered Mount Graham red squirrel (Tamiasciurus hudsonicus grahamensis). In summer 2004, the Nuttall Complex fire consumed 11, 900 ha, including a large swath of the mixed conifer stand present in the Pinalenos. Because Abert's squirrels appear to prefer open forests, the impacts of forest-opening wildfires is of potential concern to the long-term viability of the endangered native squirrel. To determine home range sizes of Abert's squirrels inside and outside of this burned area we captured and affixed radio collars to adult squirrels in burned and unburned areas. In the summers of 2006 and 2007 we collected >30 telemetry data points on all collared squirrels. Cores (50%) and home ranges (95%) of each animal were determined by fixed kernel techniques. Male and female home ranges tend to be large in this location of introduction. Both sexes clearly incorporate burned areas in their home ranges and thus do not abandon areas impacted by fire. These data are important for conservation because most research on S. aberti has been in ponderosa pine dominated forests with virtually no work completed in other habitats. Moreover, understanding effects that wildfire has on S. aberti movements outside of its native range will influence conservation strategies involving mitigating the effects that this species may have on native sciurids such as the Mount Graham red squirrel. I'm willing to have this abstract accepted as a poster if necessary.

Cougars historically occurred in North Dakota, but were believed to be extirpated from the state during the early 1900s. The animal was classified as furbearer with a closed season in 1991. In 2005, the North Dakota Game and Fish Department (Department) was directed by the state legislature to assess the status of the animal. A habitat suitability map identified the Badlands and Missouri River Breaks Region as having a sufficient amount of suitable habitat to support a population. Data from verified reports (2001-2005) and a state-wide experimental season in 2005 indicated cougars had recolonized the Badlands. Verified sightings occurred in other regions of the state, but no breeding activity outside of the Badlands was documented at that time. Current management involves 1) collecting biological information from harvested animals, 2) documenting sightings, 3) conducting field surveys, 4) educating residents about cougars, and 5) responding to cougar/human/property conflicts. Research efforts include cooperative studies between the Department and South Dakota State University to document food habits, map habitat, and assess the genetic health of Dakota cougars. Additionally, in 2008, a cooperative research project between the Department and Theodore Roosevelt National Park was initiated to assess the ecological status of cougars in the Badlands.
EFFECTS OF WILDFIRE AND FOREST HARVEST ON NORTH AMERICA SMALL MAMMALS – A METAANALYSIS

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The structure and function of North America forests have been shaped by natural disturbances, predominantly wildfires. However, forest harvest has replaced fire as the primary disturbance in most American forests. I conducted a meta-analysis on the effects of stand-replacement wildfires and several types of forest harvest (clearcutting followed by burning, clearcutting, and partial cutting) on the abundance of deer mice (Peromyscus maniculatus) and red-backed voles (Clethrionomys gapperi). Additionally, I analyzed the impacts of clearcutting and partial harvest on the abundance of a larger number of small mammal species. In coniferous and mixed forest, all disturbances except for partial harvest triggered significant increase in the abundance of deer mice and decline in red-backed voles. Deer mouse increase was strongest after wildfire, and weaker in sites that were either clearcut and burned or clearcut. The abundance of red backed voles was greatest in undisturbed or partially harvested stands, lower after clearcutting, and lowest after either wildfire or clearcutting and burning. Clearcutting of deciduous forest did not result in a consistent change in abundance of deer mice and red-backed voles. Both clearcutting and partial harvest tended to increase the abundance of yellow-pine chipmunks (Tamias amoenus), creeping voles (Microtus oregonii), and meadow voles (Microtus pennsylvanicus). Other investigated species did not show consistent response to timber harvest. Overall, the impact of different disturbances on the abundance of small mammals (i.e. positive or negative) appears to be species-specific. However, disturbance type may influence the magnitude of this effect. Disturbance types can be ranked from severe to mild in terms of small mammal responses.

EFFECTS OF FIRE ON THE SMALL MAMMAL COMMUNITY AND VEGETATION OF A TALLGRASS BLACKLAND PRAIRIE IN TX

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Fire is an important force in maintaining tallgrass prairie ecosystems. This study investigates the effects of a prescribed burn on numbers and species of small mammals in a tallgrass prairie. The study area, Leonhardt Prairie, owned by The Nature Conservancy of Texas, is a 16.2 ha tallgrass blackland prairie remnant in Falls County in eastern central Texas. Three grasses, little bluestem (Schizachyrium scoparium), big bluestem (Andropogon gerardii), and Indiangrass (Sorghastrum nutans), dominate this prairie landscape. Pre-burn sampling began in February 2007, comprising 14 trapping sessions and 2,522 trapnights over 8 months. Ninety Sherman live traps were set on three grassy sections of the prairie, 30 traps per section, every 2-3 weeks for two consecutive nights. While five rodent species were captured, dense litter and heavy vegetative cover accommodated two dominant species, Baiomys taylori and Sigmodon hispidus with a relative abundance (captures/100 trapnights) of 7.80 and 5.60, respectively. In September 2007, two of the three sections were burned and trapping protocol resumed, comprising 10 additional trapping sessions and 1,800 trapnights over 8 months. Post-burn removal of litter and cover led to an almost 35-fold increase of Peromyscus maniculatus from a relative abundance of 0.12 pre-burn to 4.05 post-burn. Baiomys taylori and Sigmodon hispidus have not been captured on the burned sections, though the unburned sections consistently produce similar capture rates to pre-burn data. Shift in species composition has occurred from Baiomys taylori and Sigmodon hispidus to Peromyscus maniculatus suggesting short-term fire response of small mammals in remnant tallgrass prairies.
112 ASSESSING STRESS IN THE ENDANGERED INDIANA BAT USING FECAL CORTISOL ASSAYS

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Chronic stress in mammals is associated with elevated daily secretion of glucocorticoids. Cortisol, the major glucocorticoid in bats, is a critical hormone that affects most organ systems and physiological processes. However, chronically elevated cortisol results in immunosuppression, increased incidence of metabolic disturbances, cardiovascular changes, and reduced fertility. Certain stimuli ("stressors") appear to be ubiquitously stressful in mammals. These include loud noise and seismic vibration, which are commonly encountered near military bases, airports, and active surface mines. While most of the circulating glucocorticoids in mammals are excreted in the urine, a small percentage of cortisol and its metabolites appear in the feces in proportion to plasma concentrations. We are investigating the long-term consequences of chronic exposure of endangered Indiana bats (Myotis sodalis) to activities associated with training and operations at nearby military bases. Fecal assays have been developed as an indirect means of assessing stress in free-ranging or endangered mammals, without the need for invasive procedures or blood sampling. We have developed and validated a fecal collection and assay procedure for Myotis sodalis. The procedure for extracting immunoreactive (ir) cortisol from fecal pellets of the little brown bat (Myotis lucifugus), an abundant, non-endangered cogener, which serves as a surrogate species, was optimized. It was then validated for M. lucifugus by demonstrating an increase in fecal cortisol levels following an increase in plasma cortisol levels resulting from handling/blood-sampling stress. The presence of ir-cortisol was then demonstrated in feces from M. sodalis; values ranged from 0.22 to 8.97 ng/mg fecal mass. Preliminary analysis suggests that Indiana bats sampled at military sites do not have higher fecal ir-cortisol levels than Indiana bats sampled at non-impacted sites.

113 TAXONOMIC STATUS OF THE DAVIS MOUNTAINS COTTONTAIL, SYLVILAGUS ROBUSTUS (LAGOMORPHA, LEPORIDAE)

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The Eastern Cottontail, Sylvilagus floridanus, is the most common and geographically widespread of all North American rabbits. In the Trans-Pecos region of Texas lives the Davis Mountains Cottontail, Sylvilagus robustus. This cottontail has an unclear taxonomy, and is thought by some to be a subspecies of S. floridanus instead of a separate species. Previous morphological data supports S. robustus as a species; however, mitochondrial DNA (mtDNA) data suggest otherwise. The objective of this study was to examine nuclear data using a DNA fingerprinting technique, amplified fragment length polymorphism (AFLP), to test the hypothesis that S. robustus is a species separate from S. floridanus. We analyzed loci from S. robustus individuals from the Davis and Chisos Mountains, S. floridanus, and S. audubonii. Preliminary results from a principle coordinate and parsimony analysis suggest S. robustus is genetically distinct from S. floridanus.
Fossorial and/or animals with no or small pinna such as shrews do not lend themselves to easy tagging, and body scarring through freezing or removal of appendages can be difficult to do in the field, harmful to the animal, or difficult to get approved by Animal Care and Use Committees. External tags can also be lost. Internal tags such as PIT tags are expensive, and may be too large or not appropriate for smaller mammals. Presented here are two studies using a tag developed for fish and herpetofauna (Visible Implant Elastomer tagging). In the first study wild Sorex spp and Myodes gapperi were tagged with both Monel ear tags and VIE in the field and tag longevity examined. Ear tags were lost in 37 of the 166 animals marked with ear tags and whose re-capture was confirmed with VIE. VIE markings were not visible in subsequent re-captures confirmed by ear tag in only 1 of 162 animals injected. Seven animals showed signs of ear tears consistent with tag loss in which no VIE was visible. These animals may have lost both tags, or may torn the ear in another manner. VIE markings remained visible throughout the field season. Over-winter retention will be investigated this season, and included in the analysis. In the second study, captive thirty Cryptotis parva were marked in the underside of the tail with VIE. Weight changes and morbidity were tracked daily for seven days and compared with a control group of another thirty animals. After one week the tagged group averaged 100.4% of pre-tagging weight while the control group averaged 101.5% of the initial weight. No animals were lost due to tagging, and behavior changes were not different between the two groups and consistent with handling rather than the injection. One month weight and morbidity data will be collected and included in the analysis.

White-nosed syndrome (WNS) was confirmed at 4 sites in the winter of 2006-2007, all within about a 7-mile radius west of Albany, NY. This syndrome is named for white fungus often, but not always, observed on the muzzle and other hairless parts of affected bats. Between 80% and 97% of bats at the 4 affected sites have disappeared thus far involving roughly 15,000 bats of 4 different species. At present nearly all sites checked within 80 miles of the original 4 locations are now affected. Some 15-20 hibernacula in New York, 4 in Vermont and at least 2 in Massachusetts are known to be affected with WNS. Affected hibernacula are characterized not only by bats with white noses or white fungus growing on other areas of the body but with bats showing abnormal behaviors including clustering near or outside the entrance of the hibernacula, flying out of the hibernacula during daylight hours, and failure of hibernating bats to arouse from tactile or thermal stimuli. All affected bats exhibit near complete loss of subcutaneous fat reserves. Although several labs are currently examining material collected from affected and unaffected hibernacula, there are no definitive results at the time this abstract was prepared. To date, numerous fungi have been isolated on specimens, including Penicillium sp. Histologically, many bats have superficial fungi on their skin; some bats have fungi invading their sebaceous glands. No significant tissue reaction is present in the affected skin. Based on the mortality
rate observed in affected hibernacula in the winter of 2006-2007 and the estimated number of bats inhabiting known affected hibernacula in the winter of 2007-2008, between 400,000 to 500,000 bats may die from white-nosed syndrome this winter.

117 DISTRIBUTION AND PHYLOGEOGRAPHY OF NORTH AMERICA'S MOST REMOTE AND POORLY STUDIED SCIURID, THE ALASKA MARMOT (*MARMOTA BROWERI*)


The Alaska marmot (*Marmota broweri*) is one of only three mammals endemic to mainland Alaska and is unquestionably the least studied marmot species in North America. Very little is known about its natural history, and even its distribution continues to be misrepresented in the literature. Prior to our research it was known from just 86 museum specimens from 15 unique localities. It was previously assumed to be restricted to the Brooks Range of northern Alaska. However, the distributional and taxonomic status of the Alaska marmot have been the subject of much confusion since it was first described as a subspecies of the hoary marmot (*M. caligata*) over 70 years ago. Through a review of all museum specimens, published accounts of this species, field surveys, and the identification of previously unidentified marmot specimens using DNA sequence data, we have determined the current distribution of the Alaska marmot to include the Brooks Range, the Ray Mountains, and the Kokrines Hills of northern and central Alaska. The Yukon River forms the boundary between the parapatric distributions of *M. broweri* and *M. caligata* in Alaska. We sequenced the mitochondrial cytochrome-*b* gene from fresh tissues and from dried study skin or other material from museum specimens up to 80 years old, including the holotype. Phylogeographic analysis of the DNA sequence data showed significant geographic structure across the range of *M. broweri* and suggests a recent population expansion from central Alaska into the formerly glaciated western Brooks Range. Ironically, this represents the first phylogeographic study of any marmot species.

118 HABITAT SELECTION AND THE EFFECTS OF FARMSTEAD REMOVAL ON MAMMALIAN WATERFOWL PREDATOR ACTIVITY

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The ecology and use of the landscape by mammalian waterfowl predators is fundamental to understanding of the phenomenon of nest predation. By understanding predator ecology we can target management practices to make permanent changes to the configuration and composition of the landscape to mitigate the risk of nest predation. We estimated resource selection functions for raccoons in Manitoba to characterize habitat selection and to identify features important to raccoon use of the landscape, and we used these models to assess the effects of abandoned farmstead removal on predator activity. Both male and female raccoons showed strong selection preferences for farmstead, forest, and wetland habitats (relative risk ratios: 6.2, 2.3, and 1.6, respectively). Distance to farmsteads ($\beta = -0.0042$, SE = 0.0003, $P < 0.0001$) and wetlands ($\beta = -0.0037$, SE = 0.0002, $P < 0.0001$) also contributed to predator use of the landscape, indicating configuration of wetlands within grassland patches and proximity of farmsteads to grasslands could increase the risk of nest predation for upland nesting birds. Removing abandoned farmsteads had a significant effect on the distribution of the probability of raccoon use of the landscape (KS-test $D = 0.548$, $P = 0.01$) and in particularly within grassland patches (KS-test $D = 0.689$, $P = 0.001$), decreasing the amount of nesting habitat at high risk
of use. Our results demonstrate that waterfowl conservation agencies should consider the role of abandoned farmsteads in managing non-native mammalian nest predators.

119 USING MICROSATellites TO DETECT BOBCAT POACHING IN MICHIGAN

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Although genetic identification of wildlife is now widely adopted in basic and applied research of natural populations, the approach has yet to be implemented and employed routinely in a regulatory context. This study utilizes genetic assignment tests to examine the influence that harvest regulations have on the frequency of misreported harvest locations for bobcats in Michigan. Bobcats (Lynx rufus), commonly harvested furbearers, are distributed throughout Michigan's Upper Peninsula (UP) and northern portions of the Lower Peninsula (LP); the two peninsulas exist as genetically distinct bobcat populations. Under harvest regulations prior to 2004, genetic re-assignment from the UP to the LP ranged from 7.7% - 13.7%, but no re-assignment from the LP to the UP. This suggested that poaching was occurring in a biased direction as hypothesized based on differing harvest limits between the UP and LP. Under current harvest regulations, we analyzed 167 bobcats at 6 microsatellite loci and found re-assignment rates from the UP to the LP ranged from 15.9% - 16.8%. This study shows that the implementation of new harvest regulations failed to decrease poaching of individuals in the LP, and may actually be helping fuel an increase in the likelihood of a harvester to start misreporting harvest locations. Our assessments are valuable for future management of bobcats in Michigan, as well as to the reliability of using assignment tests for estimating poaching rates.

120 HIBERNATION: AROUSAL AND RECOVERY FROM ADAPTIVE RENAL FAILURE

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Hibernating small mammals undergo repeated bouts of torpor in which metabolic rate and body temperature decrease to extremely low levels. As a result of the associated decline in systemic blood pressure, the kidneys virtually shut down with a massive reduction in glomerular filtration rate (GFR), loss of osmotic gradients, and associated compatible and counteracting solutes. A primary objective of this project was to examine mechanisms by which hibernators might regulate kidney perfusion during arousal and thereby facilitate the rapid recovery of normal kidney function. Blood pressure, GFR, and renal plasma flow (RPF) were measured during arousal from hibernation in white-tailed prairie dogs, Cynomys leucurus. Plasma concentrations of arginine vasopressin (AVP), angiotensin II (Ang II), and norepinephrine (NEP) were measured in a separate group of animals at various stages of arousal. Sensitivity of the renal artery and abdominal aorta to AVP, Ang II, and NEP was also ascertained for animals at various stages of arousal. Despite a rapid increase in blood pressure during arousal, RPF and GFR did not increase until body temperatures of 16.9°C and 26.5°C, respectively. It appears that the delay in kidney perfusion may, in part, be orchestrated by enhanced renal artery sensitivity to vasoconstrictive compounds early in arousal followed by a greatly reduced sensitivity to vasoconstrictive compounds as circulating levels of AVP, Ang II, and NEP increase. The delay in kidney perfusion may be necessary for kidneys to fully sequester proper osmotic gradients, as well as compatible and counteracting solutes necessary for proper kidney function once euthermic temperatures are obtained.
Ecuador constitutes a “hotspot” for scientific and conservation activities due to the number of species and high levels of endemism for several taxa including mammals. Up to the moment, bats have constituted the most diverse order of Ecuadorian mammals according to the number of species and voucher specimens deposited in museums. The purpose of this study was to update the current checklist of Ecuadorian bats with emphasis on the geographic distribution inside the country and their known conservation status. Based on museum records and previous publications, we recognize a total of 153 species which includes 16 new species described during this century for the genera: Anoura, Lonchophylla, Lophostoma, Sturnira, and Platyrrhinus, whereas there are other species for the genera Carollia, Myotis, Sturnira, Thyroptera, and Eumops that remain undescribed. The data indicates that new species were collected mainly on the Amazon basin forests, eastern and western Andean slopes, and Pacific lowlands. Due the number of species recently found we suggest continuing scientific surveys and increasing conservation efforts in order to preserve the biodiversity in the region.

Ranchers in the Flint Hills tallgrass prairie commonly burn annually in the spring to produce high quality forage for cattle. Annual burning leads to changes in plant species composition such that forbs decrease and warm season grasses increase subsequently leading to a monoculture of grasses. It is unknown what the consequences of long-term annual burning are on the small mammal community. To investigate this pattern, we used data gathered from autumn 1981 through spring 2008 on 4 permanent traplines in 2 treatment units on the Konza Prairie Biological Station near Manhattan, Kansas. One of these treatments (01D) has been burned annually for 30 years (since 1978), whereas the second treatment (N01B) was not burned from 1968-1987, but then has been burned annually for 20 years. Because the Konza Prairie LTER project did not begin until 1981, we do not have pre-burn data for 01D, but we can compare pre-burn and post-burn communities in N01B. Species richness in autumn was significantly greater in pre-burn (4.6 species) than in post-burn (3.1) communities, whereas community abundance in spring was greater in post-burn (13.0 individuals) than pre-burn (5.1) communities. On both annual burn units, species richness and community abundance in autumn has declined significantly through time. In contrast, community abundance in spring has increased significantly through time on N01B, a pattern not seen on 01D. In the pre-burn community, common species were more evenly distributed and included deer mice (28%), Elliot’s short-tailed shrews (23%) and western harvest mice (18%). In contrast, the deer mouse was the predominant species (71%) in the post-burn community. The percent of white-footed mice in the post-burn community (12%) was similar to that of the pre-burn community (13%). Our data suggest that long-term annual spring burning of tallgrass prairie leads to decreased small mammal species diversity with an accompanying change in community structure.
Prairie landscapes in the central Great Plains are noted for climatic variability and spatial variation in soils, geomorphology, and vegetation. But, do small mammals exhibit high levels of temporal and spatial variation also? When the Konza Prairie LTER Project’s Long-Term Study of Small Mammals was initiated in autumn 1981, it was expected that sampling of >10 sites over decades would allow assessment of spatial and temporal patterns in population and community characteristics. Herein, we examine species richness over space (14 permanent sampling sites; 7 experimental units, 2 sampling sites in each; different fire and grazing regimes) and time (autumn and spring samples over a 27-year period). We recorded 14 species of small mammals (12 rodents and 2 shrews). All 14 were represented in the total autumn sample of 5,283 small mammals (378 samples; 14 sites x 27 autumns), but only 12 species (or 86% of autumn richness) in the spring sample of 2,694 small mammals (2008 sampling not completed). Further, we can partition richness over space into (1) within individual sample, (2) within sampling site, and (3) within experimental unit. In autumn, average within sample richness was 3.4 species (25% of possible richness), whereas aggregation of 27 autumns of sampling yielded an average within site richness of 10.5 species (75% of possible richness) and an average within experimental unit richness of 11.9 species (85%). In spring, richness was lower at all spatial levels (within sample: 2.0 species, 16% of possible spring richness; within site: 7.1, 60%; within treatment: 8.7, 73%). Relative to temporal variation, average within year richness in autumn (all 14 sites combined) was only 8.5 species (or 61% of that possible). All in all, richness is highly variable in space and time, and regional richness is hard to estimate from 1 or 2 sites sampled for 1-3 decades or 1 or 2 years of sampling of 10-20 sites.

124 SEASONAL USE OF A GAS PIPELINE RIGHT-OF-WAY

Robert Dawley, Julie Balko, Megan Herr, Schartel, Tyler, and Ellen Dawley

We investigated seasonal effects on the use of a grassy, gas pipeline right-of-way by white-footed mice (*Peromyscus leucopus*). These mice inhabit two suburban forest fragments separated by the right-of-way (ROW) in Trappe, Montgomery County, Pennsylvania. Although these generalist rodents are most commonly found in forests, they sometimes prefer the interface (edge) between forested and grassy habitats and will even use the latter if vegetation complexity is reasonably high. A 160 meter x 180 meter sampling grid, with Sherman live traps placed at 10 m intervals, was centered on the 40m wide ROW and extended 60 m into each of the flanking forest fragments. Captured *Peromyscus* were marked with PIT tags and toe clips, and location, sex, weight, and reproductive condition recorded at each capture. During the summer, when ROW vegetation was high, resident *P. leucopus* activity, although higher in the forest interior and edge, also included ROW habitat, and some individuals crossed the ROW from one fragment to the other. During the fall, after the ROW was mowed, residents retreated from the center of the ROW and into the forest edge and interior. During the winter the ROW was abandoned altogether.

125 PATCHY DISTRIBUTION OF BATS

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Bats, in one form or another, have often appeared as heraldic devices in the official and unofficial insignia of our armed forces. Bat insignia began to flourish during the first World War and by the beginning of the second World War II, many Army Air Corps and Naval/Marine aviation squadrons had distinctive bat insignias that could be found on squadron aircraft, stationary, and the aviator’s prized leather flight jacket. In most cases, squadron insignia depict the various functions or missions of the unit, and squadron heraldry was often shared among sister squadrons in the same air group or combat wing. The first use of bat insignia by the US Navy was by Observation Squadron VOS-3S in 1923. They had been supplied with scout aircraft - Vought O2U-1 Corsair - that were so poorly suited to observation duties that both pilots and the observers complained of being “blind as bats” and this led
to their squadron's insignia. Subsequently, pilots included bats in their insignia because of the animal's remarkable ability to navigate and attack in the dark. Indeed, bats remain a popular design for night-fighter and reconnaissance squadrons throughout the world. Official insignia must conform to regulations governing size, shape, and the political-correctness of the design. However, ubiquitous, unofficial insignias vary in size and shape, and tend toward the humorous, irreverent, and even pornographic.

126 CACHE RECOVERY, PILFERING AND SPATIAL MEMORY IN A SCATTER-HOARDING RODENT: DO HOARDERS HAVE A RECOVE

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Scatter-hoarding mammals are thought to rely on spatial memory to relocate food caches. Yet, we know little about how long these granivores (primarily rodents) recall specific cache locations and whether individual hoarders have an advantage at recovering their own caches. Indeed, a few recent studies suggest that high rates of pilfering are common and that individual hoarders may not have a retriever's advantage. Here we tested this hypothesis in a high-density (>7 animals/ha) population of Eastern gray squirrels (Sciurus carolinesis) by presenting individually marked animals (> 20) with tagged acorns, mapping cache sites, and following the fate of seed caches. PITT tags allowed us to monitor individual seeds without disturbing cache sites. Cached acorns only remained in the cache site for 12-119 hrs. (0.5-5d). However, when we live-trapped and removed some animals from the site immediately after they stored seeds (thus simulating predation), their seed caches remained intact for significantly longer periods (16-27d). Cache duration corresponded roughly to the time at which squirrels were returned to the study area. These results suggest that these rodents may have a retriever's advantage and that they may remember specific cache sites longer than previously thought.

127 PREDICTIVE MODEL FOR DEER-VEHICLE COLLISIONS BASED ON LANDSCAPE AND TOPOGRAPHICAL FEATURES

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The urban deer population continues to grow unchecked. With limited hunting pressure and increasing edge habitat in which to feed, it is difficult to say how high the numbers will climb. The continued outward expansion of urban developments only exacerbates the problem by increasing the edge habitat and increasing conflicts with humans. There are approximately 700,000 deer-vehicle collisions (DVC) annually nation wide costing an estimated $1 billion. These collisions result in approximately 29,000 human injuries and 211 fatalities. The focus of our research is to utilize remote sensing and geographic information systems (GIS) to isolate the landscape and topographical features associated with sites of frequent DVC (hotspots) in St. Louis County, MO. Collision locations were provided by Missouri Department of Conservation for 2004 and 2005 in St. Louis County. ArcView map layers depicting landuse/landcover and elevation will be used to determine parameters associated with high DVC rates. We will use such GIS tools as Spatial Analyst and Patch Analyst to collect variables like percent land cover, amount of edge and habitat diversity. Then we will develop a model using logistic regression in order to query the data and isolate hotspots. We will validate the model in real time by comparing our predictions to the collision locations for 2006. To test the regional specificity of the model, we will use it to predict hotspots in Kansas City, MO and compare it to their 2006 collision locations.
128 ISOTOPICALLY ENRICHED BAITS TO NON-INVASIVELY MARK FREE-RANGING CARNIVORES

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Although dispersal is a crucial aspect of mammalian ecology, dispersal rates and distances for wide-ranging species are difficult to measure. Current methods require the capture and restraint of animals, which can be expensive, fail to collect sufficient samples and change animal ranging behaviors. Here we describe a novel, cost-effective and non-invasive method using bait enriched with stable isotopes to mark the hair of American martens (*Martes americana*). Captive martens fed isotopically labeled bait exhibited significant, progressive enrichment in the isotopic signature of both their whole blood and hair; consumption of two doses elicited a distinct mark in hair >2 standard deviations above natural abundance in < 14 days. This biomarker can be used in future field studies to rapidly mark, and document the movement and dispersal rates of individual animals across landscapes. We also provide an equation to estimate the mass of an isotopically enriched amino acid (glycine) needed to reliably mark mammalian carnivores.

129 COMPARING MOVEMENT OF EASTERN CHIPMUNKS RELEASED CLOSE TO ROADS OF VARYING TRAFFIC VOLUME

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Roads can be barriers and affect animal movement. Studies have shown a negative correlation between the traffic volume of a road and the likelihood of an animal successfully crossing the road. Eastern chipmunks (*Tamias striatus*) fitted with tracking spools were released in Rhinelander, Wisconsin from three study areas surrounding roads with varying traffic volumes. Movement data from 69 chipmunks was collected to investigate the relationship between their movement across habitat coverages (forests, shrubs, roads) and road traffic volume. These fine scale movement pathways averaged 88 meters in length. In order to assess the relative permeability of roads with these three volumes of vehicular traffic, the movement path of each individual chipmunk was rotated at equal intervals spanning 360° with the starting point fixed to create a distribution of boundary crossing frequencies. For each chipmunk's movement path this distribution of boundary crossings was used as a null model for the expected frequency of boundary crossings at each release site if the observed sequence of step lengths and turning angles occurred without regard for the local distribution of habitat cover types. The observed frequencies of boundary crossings were then compared to the release site specific expectations for each animal. These comparisons reveal that frequency of road to shrub and shrub to road crossing did not differ between the three study areas but that the departure of the observed frequency of road crossing from expectation was much greater at study areas with higher volumes of vehicular traffic. This demonstrates that even the finest scale movement patterns of eastern chipmunks are sensitive to the relative volume of vehicular traffic on roads that are proximal to areas where they are active.

130 PRELIMINARY PHYLOGENETIC ASSESSMENT OF THE MINIMUS SPECIES GROUP (*TAMIAS*)

The bulk of species diversity within chipmunks is centered on western North America where 23/25 recognized species are found. Recent studies have proposed elevation of western chipmunks from subgeneric to generic status (=Neotamias), recognized different species groups, and documented interspecific mitochondrial introgression in some instances. One species group includes the most widespread of the western species, the least chipmunk *Tamias minimus*, and five other species (*T. alpinus, T. panamintinus, T. quadrimaculatus, T. ruficaudus, and T. speciosus*) nested within a large monophyletic assemblage. However, relationships within the group are complex and *T. minimus* appears non-monophyletic. Given the extensive distribution of the least chipmunk across a wide diversity of habitats, its degree of morphological plasticity, and the apparent paraphyly within the group, it is reasonable to assume that significant phylogeographic structure also characterizes the least chipmunk. To assess this, within the context of a larger research program investigating Neotamias evolutionary relationships, we present preliminary phylogenetic results from populations of *T. minimus* collected from across its distribution, including the other member of the species group.

131 THE ROLE OF COMPETITION IN STRUCTURING A NEOTROPICAL BAT ASSEMBLAGE

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Community ecologists have long discussed the role of competition in structuring local assemblages, but its significance remains unclear. Density compensation is an expression of interspecific competition and occurs when densities are correlated positively with the degree of morphological, and therefore ecological similarity. The goal of my research is to determine if the frugivorous bat ensemble of a Neotropical bat assemblage is structured by density compensation. Research was conducted in Iquitos, Peru, in three different types of forest (primary forest, secondary forest, and mixed forest) using an ecomorphological approach and simulation models. Correlation analyses compared actual ensembles to simulated ensembles. Evidence for density compensation was quite weak. Based on 48 simulation analyses, only 5 resulted in significance, and 4 of those 5 were only marginally significant (i.e., *P* = 0.092, 0.093, 0.09, or 0.1). In secondary forest none of the analyses resulted in significant results. The interactions that take place among species of an assemblage are complex because of the effects of intrinsic characteristics of the species per se, and because of external processes that operate at different temporal and spatial scales. These complex interactions are evident in subsets of assemblages, such as ensembles that exploit the same resources. I conclude that characteristics of bats such as vagility, need for resources form multiple habitats, and consumption of food items other than fruits, as well as the effects of disturbance or source-sink dynamics, might conceal or eliminate the effects of competitive interactions on the frugivore ensemble of the Iquitos bat assemblage.

132 GENETIC IMPACT OF HABITAT FRAGMENTATION ON AMERICAN BADGER (*TAXIDEA TAXUS*) POPULATIONS

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Habitat fragmentation facilitates the loss of habitat connectivity, which leaves mammalian populations vulnerable to the detrimental effects of genetic drift and inbreeding. As a result, there has been a growing concern about how anthropogenic fragmentation, namely roads, impacts the population structure of mammals. For mammals that have high dispersal capabilities with generalist habitat preferences like the bobcat (*Lynx rufus*), studies have shown that only large highways subdivide populations. Like bobcats, American badgers (*Taxidea taxus*) are medium-sized carnivores with high dispersal capabilities, however badgers are more selective in their habitat preferences. In Michigan,
badgers primarily reside in agricultural areas, whereas in many other parts of their range, they are restricted to declining grassland and prairie areas. As a result, badgers in Michigan have not experienced the negative demographic trends seen in other populations and an understanding of the population structure of Michigan may be used to facilitate badger recovery in other areas. To investigate the population structure and potential barriers to badger dispersal in Michigan, we genotyped 60 badgers at six microsatellite loci. The analysis indicates that badgers in Michigan exist as two populations separated by the Straits of Mackinac. No genetic substructuring was found within peninsulas, therefore despite their more specialized habitat requirements, there are enough badgers successfully crossing roads to prevent population differentiation. For management considerations, genetically speaking, roads do not threaten badger population viability.

133 FACTORS AFFECTING JUVENILE SURVIVAL OF PYGMY RABBITS (BRACHALAGUS IDAHOENSIS)

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Juvenile survival is a critical parameter influencing demography in many mammalian populations. Until recently, natal behavior of pygmy rabbits was largely unknown, and no information on survival of free-ranging juvenile pygmy rabbits is available. As part of a larger study documenting dispersal of pygmy rabbits, we evaluated survival of radio-tagged juveniles at 2 sites in eastcentral Idaho. Kits (n=58) were captured shortly after emergence from natal burrows and fitted with 1-g radio-transmitters during 2004 and 2005. Tagged juveniles were located every 3-14 days until they died or until the start of the following breeding season. Mortality rates were high, ranging from 60% for males in 2004 to 100% for females in 2005. Approximately 40% of mortalities were attributed to predation. We evaluated variables influencing juvenile survival during May - August using known-fate models in Program MARK. Sixteen candidate models were evaluated that included sex, year, study area, and estimated age at tagging. Model selection results did not indicate strong support for any single combination of variables, and 3 models were within 2 ΔAICc, all of which included year and study area. Akaike importance weights indicated strongest support for year (0.8686) followed by area (0.7740) and sex (0.3333). Survival was slightly higher for males in both years of the study. Estimated age at capture had little to no effect on survival. Similar patterns of annual and site-specific variation were documented in adult pygmy rabbits. Variation among sites and years suggests that local factors are important in shaping survival of pygmy rabbits.

134 NESTING AND BURROWING MATERIAL PREFERENCES AND ACTIVITIES OF CAPTIVE GRASSHOPPER MICE

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Captive bred grasshopper mice (Onychomys leukogaster) were placed in custom built 2'X2'X4' plexiglass, compartmentalized, containers. The containers were filled with loam soil, clay soil, sandy soil, and commercial wood chip animal bedding. Individual animals were placed in the four compartment habitat and observed for burrowing and bedding activity. Preferences for bedding and burrowing when all four materials were available are described. Animals were also given access to each material in isolation. Burrowing and bedding behaviors as well as feeding activities in each environment were observed. Lastly, male-female pairs were placed in each environment and
burrowing and nesting activities reported. Habitat design is described in detail. Observations of tunnel activity including; patterns, distances, and maintenance are reported.

135 ESTIMATING SITE OCCUPANCY OF UNGULATES IN MID-TAIWAN AND DETECTION PROBABILITY BASED ON AUTO-SENSING CAMERA DATA

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It is important to account for detection probabilities for occupancy models, especially the detection probabilities are imperfect. Auto-sensing cameras are a helpful technique to monitor cryptic animal populations inhabiting in precipitous habitats. Researchers in Taiwan have been applying auto-sensing cameras to mammal research for a period. However, data acquired from cameras were usually lack of prudent analyses and thus made the research efforts futile. In this study, we demonstrate how occupancy modeling can be applied to analyses of data from auto-sensing camera. In most cases, the detection probabilities are less than one, but researchers didn’t (or didn’t know how to) take these imperfect detections into consideration. We use ungulates photo-captured in mid-Taiwan from 2003~2005 as an example to estimate their occupancy on the landscape and the detection probabilities of the cameras. The target ungulates include Sambar deer (Cervus unicolor), Reeve’s muntjac (Muntiacus reevesi), Formosan serow (Nemorhaedus swinhoei), and Formosan wild boar (Sus scrofa). The improvements as well as errors derived from occupancy analyses are described in the study. We conclude by comparing the results from occupancy modeling with that of OI indices (Occupancy index), which have been used in most research reports in Taiwan.

136 SMALL MAMMAL COMMUNITIES ALONG HIGHWAYS: SPECIES COMPOSITION AND BEHAVIOR.

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We tested the assumption that roadsides and particularly medians are low quality habitats that do not support diverse small mammal communities. We conducted this research along 30 km of Interstate 70 near the Indiana/Illinois border. At each of 7 sites we surveyed small mammal communities with Sherman traps and evaluated the animal’s perception of habitat quality using the Giving Up Density (GUD) technique in both the median and along the roadside. We expected that small mammal density and species richness in the medians would be less than in the roadsides due to the proximity of roadsides to adjacent habitat patches and differences in predation pressure. We found that small mammal communities were comparable to those found in nearby nature preserves. In total we trapped 84 individuals of 7 species. However, the community structure (relative number of individuals from each species) differed between roadsides and medians. Contrary to our prediction, the density of animals in the median was double that found in the roadsides. Differences in species density and composition could be explained by differences in predation pressure. We expected that small mammals in the roadside habitat would have higher GUDs because they are exposed to mammalian predators from the surrounding landscape whereas small mammals in medians would have lower GUDs because terrestrial predators are reluctant to cross and remain in roadways. Median trays were 3 times more likely to be foraged, yet, we found no difference in the GUD between medians and roadsides.
138 GENETIC STRUCTURE OF STRIPED SKUNK (Mephitis mephitis) IN AN URBAN LANDSCAPE

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The striped skunk is widely distributed in North America and a common inhabitant of urban areas. Striped skunks represent a reservoir and vector for the transmission of diseases that pose a significant human health risk, including rabies and the parasite Toxoplasma gondii. Information on population structure and movements of striped skunks will assist in the management of disease issues within urban landscapes. Here we present a spatial analysis of striped skunk population structure within greater Houston, Texas, USA, based on 7 microsatellite DNA markers amplified in 102 adult striped skunks. We detected weak genetic structure over the entire data set (FST = 0.031). An analysis of spatial autocorrelation based on Moran’s I revealed a large neighborhood size, where genetic structure was a function of geographic distance between individuals. Samples collected within 8-10 km were not genetically independent. Disparity of assignment index and FST values between males and females supports a male bias in dispersal. Estimates of Nm calculated from pairwise FST among 3 sampling sites ranged from 6.2-10.6 migrants per generation. Although this highly developed urban landscape is bisected by major highways with high traffic volume (e.g., Interstate 10 and US 59), we found no evidence for unique genetic clusters that might indicate barriers to dispersal. Our results indicate that local populations of urban skunks in this region encompass a relatively large geographic area. Thus, management of disease risk will require spatially extensive efforts.

139 TRAPPING IN NEWFOUNDLAND’S LABRADOR REGION: WHERE WERE THE DEER MICE?

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As part of a large project to collect deer mice (Peromyscus maniculatus) throughout their North American range, live-trapping activities were conducted at various localities in the Labrador region of Newfoundland. These localities included an interior site as well as marginal records described for this species. Large numbers of other rodents (e.g., Clethrionomys gapperi and Zapus hudsonius) were trapped at these localities; however, deer mice were not captured. The failure to capture Peromyscus maniculatus from a variety of promising habitats, and the discovery of Inuit unfamiliarity with these rodents, suggest that deer mice are presently rare or nonexistent in this region. The deer mice historically reported from Labrador may have represented small transitory populations established from animals introduced by fishing boats or cargo ships. This possibility raises the question of whether deer mice were indigenous to the type locality, and indicates the need for more extensive trapping efforts in Labrador.

140 SURVIVORSHIP OF AMERICAN MARTEN IN THE BLACK HILLS, SOUTH DAKOTA

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Estimation of demographic parameters, such as survivorship, is essential to elucidating the effects of management activities on a species. From December 1998 to March 2007, we monitored 50 (22 females, 28 males) American marten (*Martes americana*) and determined cause-specific mortality in 2 regions (central and northern) of the Black Hills, South Dakota. We documented 14 mortalities (28% of monitored population) during 1553 marten weeks. Eight (57%) marten died of predation, 3 (21%) of unknown causes, 1 (7%) died of injuries suffered after being captured in a bobcat set, 1 (7%) died from collar entrapment, and 1 (7%) was run over by an Off-Highway Vehicle. Additional analysis will be conducted using the known fate model in Program MARK to assess overall marten survivorship and to test competing hypotheses.

141 IMMUNE FUNCTION DURING HIBERNATION IN BIG BROWN BATS (*EPTESICUS FUSCUS*)

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Temperature fluctuations and food availability significantly affect the physiological responses of many seasonal mammals. For insectivorous temperate bats, like big brown bats (*Eptesicus fuscus*), the combined challenge of cold temperatures and lack of food is met by autumnal fattening followed by altered thermoregulatory balance and metabolic processes during hibernation. Despite the obvious metabolic benefits of prolonged torpor, hibernating mammals are known to arouse to euthermic temperatures periodically during the winter. Many hypotheses have been put forth to explain this paradox, but none have clearly revealed why mammals expend stored energy to warm their bodies for relatively short periods of time. In this study, we tested the hypothesis that bats arouse during hibernation in order to stimulate their immune system, either in response to potentially new pathogens or lingering infections. Immune responses are generally considered to be energetically expensive and immune competence is known to vary seasonally in relation to the costs and benefits of such competence. Individual temperature sensitive transponders were fitted to each bat and bats were either housed at euthermic/room temperature in a flight cage or artificially hibernated in environmental chambers at 4°C or 8°C. The complexity of the immune system was captured by integrating multiple measures of immune function. Preliminary data suggest that over-wintering bats maintained at euthermic temperatures have more robust immune responses than bats that are torpid. For example, over a period of three months, no wound healing was observed in bats hibernated at either 4°C or 8°C, while wounds created by 3 mm biopsy punches healed within several weeks in euthermic bats. These findings will help to better understand the tradeoff between immune function and energy expenditure, which will help to execute new conservation strategies, especially for emerging diseases like ‘White Nose Syndrome’.

142 RESPONSE TO CAPTURE VARIES BY REPRODUCTIVE STATE BUT NOT CAPTURE METHOD IN LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*)

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Bats are routinely captured in both mist nets and harp traps for a variety of reasons. The precise physiological effects of capture are not well understood, but capture and handling are known to elicit elevations in the stress-responsive glucocorticoid hormones, cortisol and corticosterone. In order to determine the time course of the stress response to capture in either harp traps or mist nets, little brown bats (*Myotis lucifugus*) were trapped and a blood sample was either immediately collected (time 0) or collected after the bat remained in the trap for 1, 2, 3, 4, 5, 10 or 15 minutes. Samples were collected during late pregnancy, lactation, post-lactation (harp trap only) and pre-hibernation (both harp trap and mist net) to assess whether the response to capture and handling differed across reproductive conditions. We hypothesized that capture would result in significant elevations in GC levels by three minutes post-capture and that capture in a mist net would elicit a greater GC response than capture in a
harp trap. In lactating, post-lactating, and pre-migration conditions, the GC response to capture was significantly correlated with time in the trap. Contrary to our initial hypothesis, capture in mist-nests was not more stressful than capture in harp traps.

143 RECOVERY OF GRAY WOLVES IN THE GREAT LAKES REGION OF THE UNITED STATES

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The Great Lakes states (here referring to Minnesota, Wisconsin, and Michigan) include the only part of the lower 48 states where gray wolves (Canis lupus) were never fully extirpated. Early proponents of wolf conservation such as Aldo Leopold, Sigurd Olson, and Durward Allen lived and worked in this region. The Great Lakes states also are the first place in the U.S. where “endangered” populations of wolves recovered. All 3 states have developed wolf conservation plans, and these populations of wolves recently were de-listed. The authors of this poster are co-editing a book of contributed chapters on this conservation success story. Here, we show population trends and status of wolves in the 3 states, and highlight some features of our forthcoming book such as distribution maps of wolves, their primary prey species, and suitable habitat in the region.

144 HUMAN DIVERSITY AND MAMMALOGY IN THE 21ST CENTURY: A REVIEW OF ASM PROGRAMS FACILITATING PARTICIPATION

Kevin C. Rowe, Dawn M. Kaufman, Laurie J. Dizney, Chris M. T. Himes, Clara B. Jones, Donald W. Kaufman, Deanna L. Martinez, Karen McBee, I. Morty Ortega, Oliver R. W. Pergams, Jorge A. Salazar-Bravo, Cody W. Thompson, Corey K. Welch, Dou-Shuan Yang, Claire A. Zugmeyer, Museum of Vertebrate Zoology, University of California, Berkeley, USA (KCR), Human Diversity Committee, American Society of Mammalogists (DMK, LJD, CMTH, CBJ, DWK, DLM, KM, IMO, ORWP, JASB, CWAT, CKW, DSY, CAZ).

The American Society of Mammalogists (ASM) is committed to encouraging the active participation by all members, regardless of gender, race, ethnic background, age, physical disabilities, or sexual preference. The Human Diversity Committee was formed to support and facilitate this goal, and has worked to highlight diversity issues, monitor ASM diversity and participation, sponsor diversity-related activities, and examine strategies to broaden the ASM diversity. Several other programs within the Society also provide resources to support the active ASM participation by a diverse membership. Grants-In-Aid, Honoraria, and Latin American Fellowship Committees provide funding opportunities for students to conduct and/or present mammalian research. The International Relations Committee enhances the participation of mammalogists outside of North America by maintaining the sponsored member program, by developing links to other mammal societies and meetings throughout the world, and by coordinating the “buddy system” to assist international authors preparing manuscripts for the Journal of Mammalogy. The Education and Graduate Students Committee administers the evaluation program for student presentations at the annual meeting and assists students in discovering mammal-related career and funding opportunities. The Public Education Committee fosters mammal education programs for grades K-12 and ensures the active participation of the next generation of mammalogists. The Office of the Ombudsperson handles issues regarding discrimination, inappropriate conduct, or other unprofessional behaviors. The objective of this poster is to assist the membership to best utilize the available resources within the Society and to encourage the use of these programs to facilitate the active participation of all members.
145 ASM-AIBS PUBLIC POLICY FELLOWSHIP

Joshua B. Smith, Department of Wildlife and Fisheries Sciences, South Dakota State University, Box 2140 B, Brookings, SD 57006, USA

As the 2007 recipient of the American Society of Mammalogist (ASM) – American Institute of Biological Sciences (AIBS) Public Policy Fellowship I had the opportunity to gain hands-on experience in public policy at the national level. From September to December 2007, I worked with the AIBS Public Policy office in Washington, D.C. disseminating up-to-date biological science information to a number of stakeholders and assisted with promoting biological research both nationally and internationally. I tracked issues of importance and summarized my findings in bi-weekly Public Policy Reports, an electronic newsletter sent to membership leaders and contacts. I attended House and Senate subcommittee hearings covering topics such as the new Energy Bill, climate change and U.S. funding for research on some of the world’s most endangered canid and felid species. Additionally, I worked with AIBS staff in planning and conducting science briefings on Capitol Hill and the 2007 USGS Coalition meeting. The opportunity to network with such a diverse array of researchers, public-policy experts and legislators allowed me to gain a greater understanding of the role the scientific community plays in interacting with the executive and legislative branches of government in crafting legislation.

146 MEXICAN FOX SQUIRREL USE OF FIRE-IMPACTED FOREST

Sandra L. Doumas and John L. Koprowski, University of Arizona, Tucson, AZ USA

Fire suppression and other anthropogenic influences have altered forest structure throughout the United States. When fire is reintroduced, native wildlife that depend upon fire-adapted forests can demonstrate varying responses related to burn severity and pattern. To investigate effects of fire severity and heterogeneity, we examined use of burned areas in the Chiricahua Mountains of Arizona by the endemic Mexican fox squirrel, Sciurus nayaritensis chiricahuae. We surveyed random line transects in burned areas for squirrel nests and feeding sign. We also assessed vegetation and fire damage characteristics every 25m along each transect to determine burn severity and pattern. We detected squirrel use in areas with nearly all levels of burn severity and heterogeneity. However, use was concentrated in areas of low burn severity, low understory density, and homogenous density of live trees. We found squirrel use only on transects with average canopy cover greater than 45%, and transects with sign had more homogenous canopy cover than those without sign. Results will increase our understanding of the role and impact of fire reintroduction to forest ecosystems. In addition, results will inform management and conservation decision-making of the effects of fire on chances for long-term survival of this sensitive subspecies.

147 DEER POPULATION CONTROL AND COYOTE PRESENCE ON THE USAF ACADEMY RESERVATION: A 10-YEAR ASSESSMENT

Edward T. Unangst, Jr., Department of Biology, 2355 Faculty Drive, Suite 2P389, USAF Academy, CO 80841 USA

The Air Force Academy, an 18000-acre mountain transitional ecosystem, supports both resident deer and coyote populations. Prior to 1990, deer populations had exceeded 1000+ animals and deer to car incidents were over 200 per year. In addition, deer fitness was a concern as well as browse overuse. In our study, we assessed the success of a hunting-control program on the deer population from 1990 to 2000. In addition, we evaluated coyote abundance and distribution derived from scent-post and responsive-howling methods over a similar 10-year period. The deer population declined over 3-fold to current stable levels of 250-350 animals over the period. Data also showed a similar and relatively constant coyote distribution in all areas of the Academy with slightly higher levels found in locations with lesser human activity (North and South boundaries). In determining coyote presence, scent post
methods consistently resulted in higher abundance ratios than howler response methods. From 1990 to 1995, deer numbers decreased from around 1000 animals to less than 400 due to heavy hunting activity. From 1995-2000, coyote abundance ratios increased from 1.0 to 2.5, suggesting a possible numeric response due to high deer numbers. From 2000 to present, both deer and coyote population are stable and indicative of a more ecologically balanced system.

148 MOUNTAIN MAHOGANY (CERCOCRAPHUS MONTANUS) PRODUCTION, GROWTH, AND WINTER-BROWSE USE BY DEER IN RESPONSE TO HUNTING POPULATION-CONTROL: A 10-YEAR ASSESSMENT ON THE USAF ACADEMY (1990-2000)

Edward T. Unangst, Jr., Department of Biology, 2355 Faculty Drive, Suite 2P389, USAF Academy, CO 80841

The Air Force Academy, an 18000-acre mountain transitional ecosystem, supports a resident deer population that was significantly reduced from 1990 to 1995 using hunting population-control measures. The deer population declined from over 1000+ animals in 1990 to current stable levels of 250-350 animals, resulting in a decrease in density from 35 animals/square mile to 15 animals/square mile. The extremely high deer populations and resulting density also impacted primary winter-browse, in particular, Mountain Mahogany. We assessed the production (total twig length / # of twigs in October), growth (total twig length / # of twigs + spurs in October), and winter-browse use (total twig length in October minus total twig length in April / total twig length in October) of Mountain Mahogany over the 1990-2000 timeframe to determine the effects of the reduced deer population. A period of high deer population and density (1990-1994) was compared to a period of lower deer population and density (1995-2000) to evaluate the deer browse effect. A significant increase in Mountain Mahogany growth (97%) and production (28%), as well as a significant decrease in winter-browse (40%), were found in response to the lowered and stable deer population during the 1995-2000 period.

148b ISOLATED POPULATIONS OF CRYPTOTIS PARVA AT THE PERIPHERY OF ITS RANGE

Z.J. Schwenke, J.K. Frey, and J.R. Choate, Sternberg Museum, Fort Hays State University (ZJS, JRC), Fish, Wildlife and Cons. Eco., New Mexico State University (JKF)

Spatially distinct populations of the least shrew (Cryptotis parva) have been documented in New Mexico. These are at the western periphery of the species’ range at Bitter Lake National Wildlife Refuge, Bottomless Lakes State Park, and BLM Overflow Wetlands in the Pecos Drainage, in the Tucumcari Basin in the Canadian Drainage, and Grulla NWR and on the Llano Estacado. Previous studies have not resolved their biogeographic history or subspecific identification. Specimens in the populations were compared with 41 specimens of C. p. parva from Ellis County, Kansas, using 3 external measurements, 41 cranial and mandible measurements, and 6 color measurements. The specimens grouped into three geographic OTUs. Hierarchical cluster analysis and principle components analysis with varimax rotation supported separation of the Pecos Drainage populations from the northern New Mexico populations. MANOVA revealed significant differences among the three OTUs, and ANOVA demonstrated significant differences in 13 variables between the Kansas and Pecos Drainage samples. To resolve the identity of the isolated populations will require larger samples for each OTU and the inclusion of a sample of C. p. berlandierii.
The Great Plains have undergone substantial change since the acceleration of United States settlement. While the massive conversion of grasslands to cropland that occurred early in the twentieth century has slowed, over the past 30 years, Great Plains land uses continue to change due to fluctuations in climate, the impacts of global economics, advances in technology, and as a result of national farm policies. For example, wet conditions in the northeastern Great Plains and drought in the western Great Plains are affecting the extent and characteristics of wetlands and lakes. Technological advances are enabling the expansion of corn and soybean production into the western and northern plains and there is agriculture intensification through irrigation in areas where groundwater is available. In addition, global market fluctuations have periodically motivated the conversion of grassland to cropland in order to take advantage of high commodity prices. The Conservation Reserve Program associated with the Farm Bill resulted in a substantial decrease in cropland across the Plains since the mid-1980s. Overall, between 1972 and 2000, there was a net decrease in croplands, a subsequent increase in grasslands, modest increases in developed land, and a variable pattern of wetlands and lakes increases and decreases. With the rising demand for biofuel crops and changes in the Conservation Reserve Program, it is quite likely that the increase in grasslands that occurred during the past 30 years will be reversed leading to substantial impacts on habitat and ecosystem services.

Predicting how future climate conditions will affect species distributions has become a primary research focus for many scientists. Species distribution modeling is a common tool used to investigate how species distributions will respond to climate change. One criticism of these methods is the inability to independently test model predictions. I have investigated this issue using data from recent range expansions of six Great Plains mammals. I tested the ability of two different species-distribution models, generalized linear model (GLM) and maximum entropy model (Maxent), to predict expansions. Data from the species’ established geographic range was used to build the model and data from expanding populations was used to validate the results of the models. Temperature, precipitation, and land cover data were used as independent variables. I used the area under the receiver operator characteristic curve (AUC) and Bayesian information criteria (BIC) to determine accuracy and fit of the models. Of the six species tested, range expansions were accurately predicted for only two species, *Mustela nivalis* and *Marmota monax*. In both cases, temperature is the most important variable when predicting locations of expanding populations. Also, my results suggested that including a non-linear, quadratic term in the model allowed for a better fit to the data. The poor model performance for the remaining species suggests that other variables (i.e. biotic interactions) may be more important for predicting those species distributions and highlights the need for continued efforts to include these types of variables into model predictions.
151 BIODIVERSITY IN THE GREAT PLAINS: WILL CLIMATE AND LAND-USE CHANGE IMPACT SMALL MAMMALS?

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The world’s native grasslands are being impacted by changes in climate and in land use (e.g., conversion to crop production, invasion by woody vegetation). In the Great Plains, climatic shifts in temperature and precipitation regimes are expected to alter production and composition of present vegetation and ultimately lead to more arid grasslands. On a different time scale, human impacts (e.g., suppression of fire, alteration of grazing regimes) are leading to ongoing conversion of grasslands to shrublands and eventually woodlands. Given that various changes have or will occur, what will the impact on small mammals be? One possible way to understand or predict the impact of climate changes on small mammals is to consider how weather (as a surrogate of climate) influences small mammals. To examine this issue, we will explore the relationships between weather factors and small mammals in tallgrass prairie on the Konza Prairie Biological Station over the last 25+ years and between demography and relative aridity of mixed grass prairie in north-central Kansas. In terms of woody invasion, increases in shrubs and trees have altered the distribution and abundance of both woodland and grassland mammals. In this case, we will explore changes in the population abundance and community composition of small mammals associated with the ongoing process of woody invasion into tallgrass prairie habitats, again, on the Konza Prairie Biological Station.

152 IMPORTANCE OF LONG DISTANCE DISPERAL TO CONSERVATION OF SWIFT FOX IN THE NORTHERN GREAT PLAINS

Kevin Honness, Jonathan A. Jenks, Shaun Grassel, Greg M. Schroeder, Robert W. Klaver, Kyran E. Kunkel, Turner Endangered Species Fund / Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD 57007 USA (KH), Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, SD 57007 USA (JAJ), Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID (SG), Badlands National Park, Interior, SD (GMS), USGS, EROS Data Center, Sioux Falls, SD (RWK), World Wildlife Fund, Bozeman, MT USA (KEK)

Long-distance dispersal (LDD) events have the potential to overcome difficulties posed by isolation and habitat fragmentation. However, their rarity make LDD events difficult to document both in frequency and magnitude and are likely under-estimated in importance to conservation efforts. This may be especially true for swift foxes (*Vulpes velox*) which are thought to exhibit limited dispersal abilities. We trapped, translocated, released and monitored 276 swift foxes (144 females, 132 males) that were reintroduced or wildborn on private lands in western South Dakota and on the Lower Brule Indian Reservation, South Dakota from 2002 to 2006. We recorded 12,302 relocations using aerial- and ground-based telemetric monitoring. Overall dispersal distance from release sites averaged 27.2 ± 7.7 km. For our purposes, LDD was defined as maximum distances greater than the 95th percentile, or 73.9 km. We documented 14 such events with an mean distance of 167.9 km. Results indicate that both reintroduced and wild-born foxes travel widely enough to provide connectivity between three reintroduction areas and the remnant native population in South Dakota. Documented LDD events may indicate the ability to provide metapopulation connectivity to core populations within the Northern Great Plains region such as those found in Colorado, Montana, Nebraska, and Wyoming.
153 DO REPRODUCTIVE DELAYS FACILITATE SPERM COMPETITION? WHAT MUSEUM SPECIMENS CAN TELL US ABOUT SEXUAL SELECTION

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Reproductive delays, which are common in many mammals, may pose an avenue for post-copulatory sexual selection that heretofore has been unexplored. We wished to explore the possibility that delays may provide an opportunity for post-copulatory sexual selection in bats, which exhibit delays following copulation, fertilization, and implantation. Because they provide a longer window over which a reproductive event may occur, reproductive delays present an ideal opportunity to ask questions about female vs. male control of reproduction. Here we investigate the potential role of delays for cryptic female mate choice and sperm competition. To assess the likelihood that species with reproductive delays have a higher incidence of post-copulatory sexual selection we conducted a comparative examination of male reproductive morphology in fluid museum specimens of bat species with and without delays. Previous work has established that in mammals, testes volume provides a signature of mating systems. We were able to examine how testes volume might correlate with reproductive delays. We tested for correlations in testes volume, penile elaborations and the presence of delays as well as average gestation length, using phylogenetically independent contrasts. Our results suggest that species with delays, particularly delayed fertilization may experience increased sperm competition as indicated by larger residual testes volume. Preservation in alcohol did not significantly affect mass of preserved bats. We also discuss phylogenetic patterns observed in bat species possessing the three types of delays.

154 PARTURITION, MOVEMENTS, AND RESOURCE SELECTION IN MULE DEER

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Many life history events such as births in large mammals are of interest to ecologists. For example, when and where mule deer (*Odocoileus hemionus*) chose to give birth in heterogeneous landscapes can have important conservation implications. Such events, however, can be difficult to detect. We investigated whether movement patterns derived from GPS telemetry collars could be used to infer the timing and location of parturition in mule deer in eastern Oregon, USA. In addition, we evaluated whether patterns of resource selection by female mule deer differed among periods associated with gestation, parturition, and lactation. Female mule deer showed a pronounced reduction in mean movement rates in early June when most were giving birth. In addition, they frequently exhibited an abrupt shift in patterns of resource selection during the week of parturition, showing selection for steeper and more northerly slopes, closeness to water sources, and forested habitats with smaller trees. Deer also avoided high densities of North American elk (*Cervus elaphus*) during parturition. We suggest that movement rates derived from GPS collars can be a useful tool in studying resource selection associated with parturition in mule deer and other large mammals.

155 PROTEIN CONTENT OF THE DIET OF THE DONOR AFFECTS THE AMOUNT OF TIME THAT MEADOW VOLES SELF-GROOM IN RESPONSE TO THE ODORS OF OPPOSITE-SEX CONSPECIFICS

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Many animals self-groom when they encounter the scent marks of opposite-sex conspecific. Self-grooming transmits odiferous substances that contain information about the groomer’s condition. The groomers condition would be affected by its nutritional state. We tested the hypothesis that the amount of time that individuals self-groom to opposite-sex conspecifics is affected by the amount of protein in their diet and that
of the scent donor. We tested this hypothesis by feeding meadow voles (Microtus pennsylvanicus) three different protein diets for 30 days and then observed their self-grooming behavior to either a control consisting of clean cotton bedding, or to bedding of opposite-sex conspecifics fed each of the three different diets, 9%, 13%, and 22% protein content. The hypothesis was partially supported. We found that the protein content of the diet of male and female groomer did not affect the amount of time they self-groomed. However, the protein content of the diet of male donors affected the self-grooming rates of female groomers. Odors produced by male donors fed a 22% protein-content diet induced females to self-groom at higher rates than did odors of males fed either a 9% or 13% protein-content diet. Interestingly, the protein content of the female’s diet did not affect the amount of time males self-groomed. These results may, in part, be explained by the natural history of free-living meadow voles as well as sex differences in costs associated with mate attraction and reproduction.

156 WHAT'S LOVE GOT TO DO WITH IT?

Nancy G. Solomon and Brian Keane, Department of Zoology and Center for Animal Behavior, Miami University, Oxford, OH 45056 USA

In the past couple decades, we have begun to realize that monogamous mammals are not always both socially and genetically monogamous. Prairie voles (Microtus ochrogaster) are one of the best-studied monogamous mammals and have even been described as the model of human monogamy. We have studied prairie voles in semi-natural enclosures for two years and have determined the social and genetic partners for adult males and females. About two-thirds of female and male founders lived with only one opposite-sex conspecific during the study. Females and males only mated with one opposite-sex conspecific at the same time early in the study, although few individuals had only one mate during the entire study. Slightly more than half of the females and males living with an opposite-sex social partner had litters sired by only one opposite-sex conspecific. Slightly more than half of paired females mated with the male with which they shared a nest. Some of the other males that mated with paired females were residents at another nest and these males had a female social partner. Surprisingly, paired females were not more genetically monogamous than females living alone. Although we already knew that socially monogamous individuals are not always genetically monogamous, we did not know the location and social status of the genetic mates. Thus, field techniques in combination with genetic methods for parentage analysis are providing new insights into the mating system of these social rodents.

157 CAN YOUNG MALE WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) SUCCESSFULLY WOO MATURE FEMALES?

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Although the mating system of white-tailed deer (Odocoileus virginianus) is described as a dominance-based hierarchy, recent studies have documented the breeding success of all age classes of male white-tailed deer. It has been suggested that the breeding success of young males is the result of exclusively mating with young females, while older males concentration their efforts on mature females. Additionally, older females may not tolerate mating attempts of younger males. We tested this idea by capturing 337 male white-tailed deer from an age-structured population (>50% of the males ≥ 3.5 years old) in south Texas from 1999 – 2006 and sampling litters of offspring. Genetic
paternity was assigned to offspring using 17 microsatellite loci to determine the role of male and female age on the distribution of breeding success among age classes. Breeding success per age class was relatively proportional to their occurrence in the population as mature males (≥ 3.5 yrs old) successfully sired 63% of all offspring, while yearling males sired 17% and 2.5-year-old males sired 20%. Our results indicate that yearling males successfully mated with females of all ages. The mean age of female mates was 5.1, 4.8, 5.0 for 1.5, 2.5, and 3.5+ males, respectively. Additionally, we documented two incidents of multiple paternity involving yearling males. There was no correlation between male and female age as young and old males successfully sired offspring with females of all ages. However, breeding success of yearling males was restricted to the peak of the breeding season when most females are in estrous. The formation of tending bonds may limit the availability of mature males during this period, and limit the ability of females to preferentially mate with mature males.

158 FREQUENCY OF MULTIPLE MATING BY FEMALE RICHARDSON'S GROUND SQUIRRELS

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Richardson’s ground squirrels (Spermophilus richardsonii) are medium-sized rodents native to the short and mixed grass prairies of Canada and the northern United States. Females emerge from hibernation about 2 weeks after males, and each female typically mates during a 2-hour period in the late afternoon of her third or fourth day after emergence. The operational sex ratio (OSR) is male-biased throughout the 2- to 3-week mating period. Although mating with multiple males can result in multiple paternity of litters in Richardson’s ground squirrels, little information is available on the frequency of multiple mating or how paternity is shared amongst a female’s mates. During the mating seasons of 2007 and 2008 we obtained observational data on the number of mates for 50 females. In 2007, 5 of 10 females mated with more than one male. In contrast in 2008, when the mating season was earlier and lasted longer, only 7 of 40 had multiple mates. The low frequency of multiple mating in 2008 resulted from mate guarding by males and the tendency for females to copulate with the male that patrolled her area and with whom she was most familiar. Microsatellites were used to confirm maternity and to assign paternity to offspring. Multiple paternity was confirmed in litters of females known to have mated with more than one male.

159 ESTIMATING DENSITIES FROM SMALL MAMMAL SURVEY DATA: AN EXAMPLE USING DISTANCE SAMPLING METHODOLOGY AT FT. CHAFFEE MILITARY TRAINING CENTER, ARKANSAS.

Thomas E. Nupp, Arkansas Tech University, 1701 N. Boulder Avenue, Russellville, AR 72801 USA

Biotic inventories of large heterogeneous landscapes such as the 26,400 ha Fort Chaffee Military Training Center (hereafter FCMTC) remain a challenging task for biologists and managers. Identification and assessment of small mammal community composition and relative abundance is a key part of larger assessments of biotic health and productivity of terrestrial communities. Traditional surveys have focused on presence/absence data to infer status of biotic communities without estimating abundance at all, or through use of indices of abundance such as captures/100 trap nights. I will present a methodology for collecting both presence/absence and density estimates of small mammals in various habitats at the FCMTC using a distance sampling methodology. I used two perpendicular transects containing 19 Sherman and Tomahawk livetraps to sample small mammals at 60 different locations at FCMTC. These sampling locations were distributed across the entirety of the FCMTC excluding active training and impact zones and represented 12 vegetation communities. Livetrapping over the period of 1-28 June 2007 resulted in 306 total captures of 260 individuals. Fifteen species of small- and medium-sized mammals were captured in 3,382 total trap nights. Species
richness did not differ among vegetation categories \((F_{11,48} = 1.41, P = 0.20)\), but capture rates measured in captures/100 trap nights differed among vegetation categories largely due to extraordinary numbers of captures in one redcedar woodland habitat type \((\text{Captures/100TN} = 33.33; F_{11,48} = 2.05, P = 0.04)\). I will compare and contrast density estimates derived from Program DISTANCE to capture rates estimates to determine the practicality of density estimation using distance methods on survey data.

160 NOCTURNAL BEHAVIOR AND ROOSTING ECOLOGY OF *PERIMYOTIS SUBFLAVUS* (EASTERN PIPISTRELLE) NEAR INDIANAPOLIS INDIANA, INTERNATIONAL AIRPORT.

Jared S. Helms, Dale W. Sparks, and John O. Whittaker, Jr., Center for North American Bat Research and Conservation, Indiana State University, Terre Haute, Indiana 47809 USA

In summers 2005-2007 we radio-tracked 11 adult female eastern pipistrelles (*Perimyotis subflavus*) to day roosts and foraging in areas near the Indianapolis International Airport. Most bats roosted within the foliage of trees, but some also made use of a covered bridge in a suburban park. These bats foraged extensively in undeveloped habitats such as woodlots, wetlands, and agricultural fields while avoiding developed areas such as subdivisions and strip malls. Bats flew an average of 1924 m from their day roosts and nocturnal home ranges \((95\% \text{ Minimum Convex Polygons})\) averaged 320 Ha. This study constitutes the first detailed study for the foraging behavior of this species. As such, it will help wildlife managers better understand the impact of urbanization in bats.

161 ALTERED PREDATOR-PREY RELATIONSHIP IN URBAN LANDSCAPES: THE COYOTE AND THE GOOSE.

Justin Brown and Stanley D. Gehrt, The Ohio State University, Terrestrial Wildlife Ecology Lab, Columbus, Ohio 60118.

It is generally accepted that urbanization has the potential to alter predator-prey relationships; however, alterations in this relationship resulting in top-down effects for a top carnivore has rarely been demonstrated. Coyotes have recently become top predators in many North American metropolitan landscapes, but their ecological role in such landscapes is poorly understood. We assessed whether coyotes can exert top-down control on Canada geese in the Chicago area. Within this system, nest predation appears to be a limiting factor. Thus, our objectives were to: 1) identify the relative importance of coyote on goose nesting success, and other population dynamics and 2) use our data to model the effects of coyotes on the growth rate of the goose population to determine what degree top-down pressure is affecting the goose population. To identify the relative role predator species have on Canada goose population dynamics, we monitored 286 nests in 2005 using time-lapse infrared video cameras, plasticine eggs and/or sign collected at depredated nests. All three techniques only identified raccoons and coyotes as nest predators. Raccoons and coyotes were responsible for 22-25% and 75-78% of all Canada goose nest depredation. To determine the potential influence of coyotes on the Canada goose population, we created a Canada goose matrix population model that includes variables such as coyote predation on adults and nests as well as coyote influence on nest desertion. Using the base population model we calculated the Canada goose population to be increasing with \(\lambda=1.055\). The removal of all coyote influence on the goose population increased \(\lambda\) to 1.214. Model elasticity suggested nest predation was the most important coyote related factor; the removal of coyote nest predation from the model resulted in a \(\lambda = 1.157\). Our modeling results suggest coyotes are serving as a limiting factor for the Chicago areas Canada goose population.
162 DIFFERENTIAL RESPONSES TO URBAN LAND USE BY MESOPREDATORS IN THE CHICAGO METROPOLITAN AREA.

Alison Willingham, Stan Gehrt, Chris Anchor, The Ohio State University, Columbus, OH (AW, SG), Cook County Forest Preserve District, Chicago, IL (CA)

Urbanization is a prominent force that is reshaping landscapes across the world. The resulting changes in land use as well as the increased fragmentation of natural lands and altered resource distributions can affect wildlife in significant ways. We focused on mammalian mesopredators, which are underrepresented in the urban literature, primarily due to their secretive nature as well as the difficulties associated with working in an urban environment. Our study was based in northeastern Illinois, both in and around the Chicago metropolitan area, one of the most highly urbanized and populated regions in the country. Our goal was to assess the relationships between landscape variables on the presence or absence of members of the urban predator community. We conducted scent station surveys between 2004 and 2007. We ran 562 scent stations over this time period, 118 of which were resampled at least once. Stations were primarily placed in forest preserves, golf courses, cemeteries and, occasionally, in residential yards. The most commonly detected predator species was raccoon (54%), followed by opossum (32%), coyote (22%), domestic cat (8.6%), fox (red and gray; 5.5%), and striped skunk (4.7%). We used a redundancy analysis (RDA) to assess the relationship between the presence of mesocarnivores and the proportion of nine different land cover classifications within a 3.14 hectare buffer centered on each station. Preliminary analyses have resulted in no strong patterns emerging between urban predator presence and the habitat variables. These findings may be a result of the strong adaptive nature of these urban species.

164 HOME RANGE SIZE OF VIRGINIA OPOSSUM (DIDELPHIS VIRGINIANA) WITHIN AN URBAN ENVIRONMENT

Jeffrey D. Wright and M. Scott Burt, Department of Biology, Truman State University

Over the past few decades, the United States has become more and more urbanized, leading to a shift from natural habitat to human-dominated landscape. This new landscape is marked by buildings, roads, parking lots and other structures devoted to human use. Urbanization of habitat has increased the number of human/wildlife interactions and it is important to learn how wildlife responds to their new habitats in order to effectively manage these interactions. The Virginia opossum (Didelphis virginiana) is a habitat generalist that regularly occurs in urban centers but little is known about the life history of opossums that live in these areas. This study investigates the home ranges of opossums within the city limits of Kirksville, MO to better understand how these animals are occupying human-dominated habitats and identify possible differences between those populations and populations in more natural environments. From May 2007 to April 2008, opossums inside the city limits were captured, collared and tracked throughout the year. The program Locate III was utilized to delineate the animals' specific location and home ranges were calculated using ArcGIS 9. Calculated home ranges were compared to home ranges from past research in natural areas in an attempt to identify a difference in the area opossums utilize between urban and natural areas, with the prediction that those living inside Kirksville show smaller home ranges on average. In addition to the home range study, a small sample of opossums were captured and weighed in Kirksville and at Big Creek Conservation Area to determine if the two populations had different average weights. Such data on body weight could provide insight into habitat quality and a difference in available nutrients and physiological requirements of opossums living in an urban environment versus those living in their original habitat.
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Hantavirus, a zoonotic disease hosted by deer mice, *Peromyscus maniculatus*, in forested ecosystems. No other ecological or environmental variable that was considered in this study, alone or in combination, predicted the amount of Hantavirus in an ecosystem. By suppressing zoonotic disease, biodiversity provides a service that directly affects human health and well-being, a phenomenon that will hopefully help strengthen conservation efforts.

**168 MAMMALIAN MORTALITY DURING PREDATOR CONTROL ACTIVITIES IN THE UNITED STATES**

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In the United States, predator control is a widespread human activity which has occurred since the time of the earliest settlers. Today, predator control activities are allotted substantial resources and result in the mortality of large numbers of target and non-target mammalian species. Many different methods are used by both federal and state predator control agencies, and the two primary methods are poisoning and shooting. Much predator control effort is focused on the coyote, and approximately 80,000-100,000 coyotes are killed each year by a single federal agency, USDA - Wildlife Services. Other species for which control focus is placed include gray wolves, mountain lions, grizzly bears, and black bears. In the process of controlling these mammalian predators, many other mammalian species become casualties, including other canids (foxes), felids (bobcats), mustelids (badgers, river otters, wolverine, marten, fisher), skunks, beaver, porcupine, and several other species. This study examined predator control in the United States back several decades, when reliable records were first kept on mortality of non-target mammalian species. I report annual and cumulative mortality rates for target and non-target mammalian species subject to predator control activities in the United States. Factors such as livestock husbandry, human attitudes towards mammalian predators, and the possible implications of widespread killing of so many mammals on an annual basis are discussed in this study.

**169 INTERACTIVE EFFECTS OF PRAIRIE DOGS AND CATTLE ON CHIHUAHUAN DESERT GRASSLAND SYSTEMS**

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An ongoing and intense debate exists on how the cattle industry can co-exist with native herbivores like prairie dogs (*Cynomys* spp.). In order to determine how to manage and conserve the central grasslands of North America in the face of multiple and often conflicting interests, there is a great need to understand how these animals together and independently affect the grassland system. To address this, our research is evaluating the independent and interactive effects of domestic cattle and black-tailed prairie dogs (*C. ludovicianus*) on Chihuahuan Desert grassland ecosystems using a long-term, large-scale, manipulative experiment. Our research is being conducted in the Janos region of northern Chihuahua, Mexico, which supports one of the largest remaining complexes of black-tailed prairie dogs. Our initial results show that the treatment plots with both prairie dogs and cattle occurring together had lower plant height and cover compared to the areas where each species occurred alone. These results indicate that cattle and prairie dogs are indeed having important, combined effects on the grassland that differ from the effects of the animals alone. Short-term and
long-term studies can reveal very different results and insights into community dynamics, and therefore, it will be essential to follow the effects of these herbivore manipulations over the long-term.

170 STRATEGIES FOR MONITORING SKUNK POPULATIONS IN TEXAS

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Texas is the only state with all five skunk species found in the United States. With the exception of striped skunks, *Mephitis mephitis*, we know little about the biology of skunk species in the state. We present the current state of knowledge about distribution and conservation status of western and eastern spotted skunks (*Spilogale gracilis*, *S. putorius*), hog-nosed skunk (*Conepatus leuconotus*), and hooded skunk (*Mephitis macroura*) in Texas. We evaluated several detection methods for the study of skunks in west-central Texas where 3 species (striped, hog-nosed, and western spotted skunks) occur sympatrically. The detection methods evaluated were camera traps, open track plates, covered track plates, and roadway mortality surveys. Effectiveness of these methods varied according to species, season, and habitat. Striped skunks were detected by all methods. Western spotted skunks were most effectively detected by covered track plates during winter and fall. Hog-nosed skunks were best detected during roadway mortality surveys. Our data indicate that developing a comprehensive strategy to monitor population and distributional trends in Texas skunk species will require the use of multiple methods.

171 INDIRECT FITNESS BENEFITS DO NOT COMPENSATE FOR THE LOSS OF DIRECT FITNESS IN YELLOW-BELLIED MARMOTS

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The contribution of indirect fitness to inclusive fitness is expected to increase as the reproductive skew increases, with indirect fitness being the only component of inclusive fitness of sterile individuals in eusocial species. However, the relative contribution of indirect fitness to inclusive fitness has rarely been evaluated empirically. Using data from a long-term study (1962-2003), we show that female yellow-bellied marmots that have a later age of 1st successful reproduction incur a substantial loss of direct fitness with no corresponding gain in indirect fitness. Additionally, although females that survive to reproductive age but do not successfully reproduce have a greater indirect fitness than those that reproduce at least once, indirect fitness benefits of foregoing reproduction are insufficient to compensate for the loss of direct fitness resulting from later reproduction. Although indirect fitness composed 22.2% of the inclusive fitness of females that reproduced at least once, females that reproduced at least once had 2.3 times higher inclusive fitness than those that survived to reproductive age but never reproduced. These results suggest that, in yellow-bellied marmots and other species with similar life histories, the contribution of indirect fitness to inclusive fitness does not compensate for loss of direct fitness.

172 OPTIMAL FORAGING BEHAVIOR OF *PEROMYSCUS LEUCOPUS* DURING WINTER.

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Endotherms foraging at temperatures far from their thermal neutral zone pay an increased energetic cost of foraging. I hypothesized that this additional cost of foraging should increase a forager’s quitting harvest rate (QHR) in depleting food patches. I predicted that mice foraging during the winter would have a higher QHR on colder nights and in patches that did not have artificially increased temperatures. I also predicted that mice in a cold patch should use a harvest strategy that reduces their time in a food patch while increasing their harvest rate; I call this strategy Grab-and-Go foraging (GAG), in contrast to Eat-at-Tray foraging (EAT). To test these predictions I assayed changes in QHR using the forager’s Giving Up Density (GUD), which is the amount of uneaten seeds remaining in an experimental feeding tray. In Oct. 2007 I placed 16 *P. leucopus* in a 10m x 10m forested outdoor enclosure in Indiana. The enclosure contained a large central brush pile, nest boxes, and 8 foraging stations. Each foraging station consisted of an upside down opaque storage bin with entry holes at the bottom. In each bin was a seed tray with 6g of millet mixed evenly in 4L of sand. Each night from January 12th to March 13th 2008, I assigned 4 trays “cold trays” (at ambient temperature), and 4 trays as “hot trays” (trays with a ceramic no-light heat bulb). The bulbs increased the bin temperatures ~10-15 °C. Each morning the sand was sifted and the remaining seed and seed husks were collected to measure GUDs and harvest strategies. My results support the hypothesis. Nightly ambient temperature was negatively correlated with GUDs. Furthermore there was an interaction between tray temperature and ambient temperature. On cold nights mice had lower GUDs in the “hot trays”, but on warm nights the mice had lower GUDs in the “cold trays”. As predicted, the mice used more Grab-and-Go foraging in “cold trays” than in “hot” trays.

173 CAUSES OF MORTALITY IN RICHARDSON'S GROUND SQUIRRELS

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All animals die, but the exact fate of individuals is usually not known. Furthermore, causes of mortality are likely to vary with age, sex, season and year, with the timing and extent of mortality events influencing population size and recruitment. Over a 20-year period, I censused a population of Richardson's ground squirrels (*Spermophilus richardsonii*) in southwestern Alberta, Canada, on a near daily basis with the aim of determining when and why animals died. Population size varied ten-fold from 34 to 371 adult squirrels on emergence from hibernation. Annual recruitment of juveniles into the adult population ranged from 5 to 60% for females and 3 to 20% for males. Year-to-year survival ranged from 25 to 75% for adult females and 0 to 20% for adult males. Badgers (*Taxidea taxus*) were the only significant predators of infants and hibernating squirrels, accounting for the loss of up to 40% of litters and 60% of hibernators in some years. Summer-time predation by a lactating badger resulted in the highest year-to-year mortality for all age and sex classes. Predation by great horned owls (*Bubo virginianus*) was primarily limited to estrous females and males during the mating season, whereas predation by Swainson's hawks (*Buteo swainsoni*) primarily occurred in summer and was most intense on juvenile squirrels in years in which hawks successfully reared chicks. Lethal myiasis by maggots of a flesh fly (*Neobellieria citellivora*) occurred in late summer and predominantly affected juvenile males. Natural predators that had little effect on the population included prairie falcons, goshawks, ravens, coyotes, and long-tailed weasels. Flooding killed active animals during the summer in 2 years and hibernating animals in the autumn of one of those years, resulting in a significant decline in the population. Anthropogenic factors included farm dogs and cats and vehicles on an adjacent road.

174 SOCIAL SUBDIVISION INFLUENCES EFFECTIVE POPULATION SIZE IN THE COLONIAL BREEDING BLACK-TAILED PRAIRIE DOG

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Using a long term study of black-tailed prairie dogs (*Cynomys ludovicianus*), we asked whether subdivision of a subpopulation (colony) into social breeding groups (coteries) influenced gene dynamics. We measured gene dynamics with common statistical tools developed by Wright (1969): $F$-statistics and effective population size ($N_e$), but at a finer scale to account for coteries. We used two methods of estimating the gene dynamics of subgroups, developed by Chesser (Chesser et al. 1993; Sugg and Chesser 1994) and Nunney (1999). We determined if these methods produce similar results, congruent with an empirical measure of effective population size ($N_{emp}$). Modified $F$-statistics were estimated from pre- and post-dispersal data from pedigrees and allozymes. Both indicated significant genetic sub-structuring of the colony subpopulation into coterie breeding groups. The rate of inbreeding of individuals relative to the coterie lineage indicated lower than expected inbreeding at the coterie level. Inbreeding of individuals relative to the colony was consistent with random mating. Asymptotic effective size estimates varied substantially. Chesser’s method produced estimates of 77 (range 69-90, pedigree) and 86 (range 70-111, allozyme) individuals, which are consistent with the $N_{emp}$ of 76. Nunney’s method produced much lower estimates of approximately half the $N_{emp}$. Social subdivisions of the colony into coteries clearly influenced gene dynamics. Only the Chesser method accounted for genetic structure introduced by genealogy: both from polygynous mating and matrilines of philopatric females. This may prove important when estimating the rate of loss of genetic variation in highly social mammals.

175 LONG-TERM STUDY OF POPULATION DYNAMICS OF TWO SMALL MAMMAL SPECIES IN THE EVERGLADES

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Long-term monitoring studies of animal populations give ecologists a greater ability to identify patterns of interactions between animal populations and their environment that may not be detectable by short-term studies. Here we present the results of a long-term study monitoring two small mammals, *Sigmodon hispidus* and *Oryzomys palustris*, in hardwood hammock islands within the Everglades National Park, Florida, USA. We used mark-recapture trapping to monitor small mammals on 17 hammock islands for nearly 109 consecutive months between February 1994 and December 2005. We examined the relationships among animal abundance, density, reproductive condition, movement distance, movement frequency and how each of these factors are influenced by island size and water depth. The small mammal community within Everglades’ tree islands is primarily composed of the cotton rat (*S. hispidus*) and the marsh rice rat (*O. palustris*), with cotton mice (*Peromyscus gossypinus*) representing less than 1% of captures. Tree-islands were arbitrarily classified into three size classes by area. The results of this analysis revealed two interesting insights into the natural history of these species: 1) Large islands appear to be the source of cotton rat recruits. Sixty-five percent of reproductively active adults and 82% of juveniles were captured on large islands. 2) Contrary to our expectations, water-levels did not significantly influence the average movement distance of hispid cotton rats or marsh rice rats, and movement distances did not differ between the species. The results of this analysis suggest that decreasing tree island size and overall area will likely negatively influence the small mammal community by affecting population recruitment rates.
176 SEASONAL CHANGES AND CANALIZATION IN SURVIVAL AND REPRODUCTION OF SMALL MAMMAL POPULATIONS

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Populations are differentially sensitive to changes in survival and reproduction. A relatively small change in a vital rate to which a population is highly sensitive may have a large effect on the growth of that population whereas a relatively large change in a vital rate to which the population is not sensitive may have little impact on the population growth. One would expect natural selection to act on the most sensitive vital rates as optimizing these vital rates would lead to the highest fitness. The action of natural selection is then expected to reduce the variability of the most sensitive vital rate, a process known as buffering or environmental canalization. We used a long-term data set of four species of small mammal (Sigmodon hispidus, Microtus ochrogaster, Peromyscus leucopus, and P. maniculatus) to test for the presence of canalization in survival and reproduction. We calculated the sensitivity of vital rates for a series of monthly matrices for each population. We then related these measures to a standardized variance for each vital rate. Preliminary analyses suggest that populations of small mammals are most sensitive to changes in adult survival and reproduction and relatively insensitive to changes in survival of young. Further, there is little suggestion of canalization as adult survival and reproduction were the most variable vital rates.

177 CORRECTING MISCONCEPTIONS? ELEMENTARY TEACHERS' IDEAS OF THIS THING CALLED..."SCIENCE."

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Elementary teachers are required to teach all subject areas in their classroom. With the advent of high stakes testing as mandated by the No Child Left Behind Act, teachers now must prepare their students for a battery of standardized tests in several subject areas, including: math, reading, social studies, and science. Oregon, in addition to these subjects, requires student work samples of an inquiry-based project in which students, throughout their school careers, develop more sophisticated approaches to this method. However, many graduate programs in teaching do not emphasize science, and as a result, most Pre-K through 5th grade teachers do not understand even so much as the fundamentals of science. In a 10-week class, two groups, classroom teachers and pre-service teachers, engaged in a science course highlighting inquiry designed for elementary teachers. During the first week of both classes, all students were asked to complete a survey with the following questions: What is science? What is the scientific method? What is evolution? The classroom teachers were also asked: How comfortable are you guiding your students in the inquiry process? These same questions were asked in the final week of class. Pre-service and classroom teachers’ responses were compared, as well as the individual change through the class. The results are mixed, as some teachers identified and corrected their misconceptions about science, and others could not resolve the discrepancies between their ideas and the science presented before them.

178 EXPLORING NATURAL HISTORY PATTERNS IN AN EXTENSIVE ONLINE DATABASE, THE ANIMAL DIVERSITY WEB

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In the Exploring Natural History project, the Animal Diversity Web (ADW) at the University of Michigan Museum of Zoology uses its structured database to develop powerful interactive tools for querying natural history data. With over 3000 species accounts, 18,000 media files, and serving 5 million pages to half a million users a month, the ADW is one of the largest natural history databases online. Mammal content is the greatest strength of the Animal Diversity Web, with 1583 taxon accounts, representing almost 30% of all mammals, 6400 live animal images, and 2500 specimen images. Although ADW accounts appear as narrative text online, the underlying data are highly structured, creating a unique opportunity to explore natural history patterns in animal taxa. The ADW team has created an advanced search tool that allows users to combine text, keywords, and data field content in their searches. This tool is integrated with online course workspaces where students can save, modify, and report the results of their searches, and discuss what they mean (http://animaldiversity.ummz.umnich.edu/quaardvark/). The search tool also permits queries of specimen images and customizing the output for comparing important morphological and dental features. The utility of the search tool and associated course workspaces was tested at six undergraduate institutions representing a variety of biology courses and institutions, from a community college to research universities. Results suggest wide applicability of this tool to organismal biology courses. Enabling active student investigation into natural history patterns can enhance student learning experiences, especially in undergraduate settings where opportunities for field courses are limited. A brief demonstration of the query tool and workspaces will be given and the results of our research on the effectiveness of this tool will be reported. This tool is freely available online and we welcome your participation!

179 FIELDWORK AND WILDLIFE DISEASES: CONCERNS FOR BOTH HUMAN WILDLIFE HEALTH

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The recent death of a biologist at Grand Canyon National Park from pneumonic plague following the necropsy of a mountain lion (Puma concolor) brought national attention to the issue of zoonotic diseases. In the study of mammals, there actually are two issues at hand, one being the potential transmission of diseases of animals to humans, and the second is that humans may be spreading diseases among wildlife. As two case study examples, we will discuss the plague incident and response by cavers to the white-nose syndrome occurring in bats in the northeast. Humans working with mammals could potentially be exposed to a variety of diseases, including hanta virus, tularemia, Tyzzer's disease, rabies, tuberculosis, and brucellosis, among others. Preparation for fieldwork should consider personal protective equipment and sanitization protocols for sampling/trapping equipment to protect both human and wildlife health. Incidental disease transmission by researchers conducting fieldwork is an area that may not receive due consideration. As a result, heightened awareness and preparation for wildlife diseases is essential in study design.

180 DO KANGAROO RATS INDIRECTLY FACILITATE HARVESTER ANTS? IMPLICATIONS OF INTERSPECIFIC SPATIAL PATTERN

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Spatial patterns of structures (e.g., nests and burrows) in animal populations can provide insight into underlying ecological processes. Banner-tailed kangaroo rats (Dipodomys spectabilis) and harvester ants (Pogonomyrmex rugosus) are the largest and most dominant granivores found in rodent and ant communities of the northern Chihuahuan Desert. Both species build conspicuous, above-ground structures and are highly territorial. Kangaroo rats are hypothesized to indirectly facilitate (i.e., indirect positive effect on one species by
another) harvester ants by foraging on large-seeded annuals, thereby reducing competition for small-seeded annuals that are utilized by ants. I tested the indirect facilitation hypothesis by examining interspecific spacing patterns of mounds and colony discs built by coexisting banner-tailed kangaroo rats and harvester ants, respectively. Locations of mounds and colonies at the Sevilleta LTER, New Mexico were analyzed using spatial point pattern techniques (nearest neighbor and Ripley's K). Harvester ant colonies and kangaroo rat mounds were spatially associated with each other at nearest neighbor and fine scales (< 10 m) and independent at greater scales. Occupied mounds exhibited a stronger spatial association with harvester ant colonies than unoccupied mounds. Spatial association between species supports the hypothesis of indirect facilitation of harvester ants by kangaroo rats. Kangaroo rats may affect colony recruitment and mortality of harvester ants near mounds through their local effects on soil and vegetation. After a mound is abandoned, residual effects of kangaroo rats on harvester ants may be short-lived (< 2 years).

181 CAN MAPPING OF STABLE ISOTOPES IN TISSUE SUPPLANT RADIOTELEMETRY TO IDENTIFY NUTRITIONAL SINKS FOR LARGE GENERALIST HERBIVORES?

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Researchers often attempt to identify subpopulations of large herbivores that occupy disparate landscapes using expensive VHF or GPS technology. Although movements and range use can be identified through radiotelemetry, delineation of nutritional sinks may provide enough detail for research objectives. We assessed δ¹³C and δ¹⁵N in tissue of free-ranging elk (*Cervus elaphus*) from disparate habitats of mixed prairie-oak savannah and agricultural crops in a landscape dominated by C₄-plants. Muscle and hoof samples were collected from female and male elk on 2 subpopulations (forest, grassland) from private land and 1 subpopulation from the Wichita Mountains Wildlife Refuge (refuge) in 2001–2006. We plotted locations of harvested elk along with their respective δ¹³C and δ¹⁵N in GIS for the 3 elk subpopulations. Raster-based maps were created for hoof and muscle δ¹³C and δ¹⁵N with kriging interpolation in ArcMap 9.1. These maps identified isopleths for δ¹³C and δ¹⁵N in tissues for subpopulations of elk identifying nutritionally favorable landscapes. Comparison of δ¹³C and δ¹⁵N could be used to assess subpopulation-specific use of agricultural crops in landscapes throughout North America. Furthermore, subpopulation delineation could potentially be accomplished over a range of landscapes for management of free-ranging ungulates without the need for labor intensive capture and tracking protocols.

182 EVOLUTIONARY ANALYSIS OF A NEWLY IDENTIFIED ID-LIKE SINE FAMILY IN THE GUINEA PIG GENOME.

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The ID retrotransposon family of short interspersed DNA elements (SINEs) has amplified to various levels among rodent genomes, but only roughly 100 copies are present within the guinea pig genome. We therefore investigated the guinea pig genome for alternative SINE families using A-B PCR, and identified a novel ID-like group of elements we refer to as GPID-L (guinea pig ID-like). Based on an Ensembl BlastView database search, we estimate over 100,000 copies of this SINE family are present within the guinea pig genome. RT-PCR analysis of germ line tissue, in addition to genomic elements with high sequence identity to a consensus sequence suggest current activity of GPID-L in the guinea pig. Using intra-GPID-L PCR among various analyzed rodents suggests hystrocognath suborder specificity of this SINE family. Further investigations analyzing individual elements from various hystrocognath rodents are underway to help ascertain the evolutionary history of this SINE family.
183 PLIOCENE PARK: ANCIENT HAPLOTYPES IN *CHAETODIPUS FORMOSUS* FROM ARIZONA STRIP.

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The Long-tailed Pocket Mouse, *Chaetodipus formosus*, and the Little Pocket Mouse, *Perognathus longimembris*, have similar distributions to the West and North of the Colorado River in the southwestern states of California, Nevada, Utah, Arizona, and Baja California Norte. My previous work revealed that populations of *P. longimembris* from the Arizona Strip area (i.e. the region north of the Grand Canyon, south of the Utah state Line, and east of the Virgin River) are substantially divergent from the remaining populations of that species, and thus are reconstructed as long basal branches on phylogenies. Given the similarity of distribution of *C. formosus* and *P. longimembris*, are the populations of *C. formosus* from the Arizona Strip similarly divergent? I present phylogenetic analyses of mitochondrial cytochrome-\(b\) and nuclear beta-fibrinogen intron 7 sequences that indeed reveal the Arizona Strip populations of *C. formosus* to be divergent from the remaining populations, and basal on the phylogenies. Similar to the case in *P. longimembris* the remaining populations of *C. formosus* in California, Nevada, and Utah are all quite similar to one another, suggesting a recent range expansion, possibly pursuant to the last Pleistocene glaciations. I postulate that the Colorado River (Grand Canyon), and the Virgin River constitute(d) a V-shaped dispersal trap during the glaciations preventing the southward retreat of these pocket mice during colder wetter times. They thus remained isolated from more panmictic western populations of their respective species.

184 BIODIVERSITY, MAMMALIAN EVOLUTION, AND DISEASE SURVEILLANCE IN CENTRAL ASIA

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From 18 to 29 June 2007 a Sowell/CRDF Expedition to the Kyrgyz Republic (Kyrgyzstan) was conducted by Texas Tech University, SUNY Buffalo School of Medicine, Ministry of Defense: Porton Down of the United Kingdom, the National Academy of Sciences of the Kyrgyz Republic, and the Republican Center for Quarantine and Especially Dangerous Diseases of the Kyrgyz Republic. Goals of this expedition were to generate preliminary data on species of small mammals distributed throughout the country and to survey collected mammals for zoonotic viruses. We prepared vouchers and collected tissues from 185 specimens of rodents and shrews from 4 collecting localities. Prior to this collecting effort, only 8 specimens of mammals from the Kyrgyz Republic were listed in the MaNIS database as archived in accredited museums in the United States. We present phylogenetic and phylogeographic results from the rodent genera *Alticola, Apodemus, Dryomys, Microtus, Myodes*, and *Rattus* as well as the soricid genus *Crocidura*. Results indicate that the mammalian fauna of the Kyrgyz Republic has complex biogeographic connections with East Asia, South Asia, and East Europe. Our data provide phylogeographic evidence of recent (< 20,000 ybp) colonization events by at least two genera (*Apodemus* and *Crocidura*) into the Kyrgyz Republic. We hypothesize that zoonotic agents were introduced by colonization and will have affinities to pathogens at the geographic origin of colonizing mammals.
Most bat species in the United States are known reservoirs of rabies virus (RABV), although prevalence of infection in natural colonies varies across species. Despite the historic association with bats, our understanding of RABV epizootiology in natural populations is in its infancy. Brazilian free-tailed bats (Tadarida brasiliensis) have long been recognized as a reservoir and vector of RABV and, among bats in the US, appear to exhibit the highest levels of viral exposure. Brazilian free-tailed bats are unique in their diverse behavioral and roosting ecology. Across their geographic range in the US, colony sizes vary by several orders of magnitude and can have significant seasonal fluctuations. Roosts for Brazilian free-tailed bats are often found in or near urban and agricultural settings. Banding studies have confirmed that many Brazilian free-tailed bats engage in long-distance seasonal migrations to Mexico, although colonies in the southeastern and far-western US may remain in local roosts year-round. Cycles of infection within and across colonies may be influenced by the dispersal of bats across the landscape, variation in colony size and structure, and local ecology. We present evidence of RABV exposure in natural colonies of Brazilian free-tailed bats, at 13 roosts in the southern United States, across the reproductive season. We used hierarchical statistical models to investigate the importance of local and landscape ecological factors in explaining RABV exposure. Our results indicate significant local variation of RABV exposure in natural colonies across the geographic range, but do not suggest elevated exposure at man-made versus natural roosts. Ecological associations of the virus and host are critical for developing predictive models to improve our management of bat rabies in the US.

The Neotropical river otter (Lontra longicaudis) has a wide distribution, but numerous factors like habitat destruction, competition with the fisherman, and illegal hunting, has situated the species on red lists. Little is known about the genetic structure and diversity of the species. Only one paper referring to its genetic diversity has been published. In order to contribute to the knowledge of its genetic situation, the goal of this presentation is to describe the genetic structure and diversity of the Neotropical river otter in the Lacantún River and five of its major tributaries; located in southern area of the Montes Azules Reserve in the Lacandona rainforest. Non-invasive sampling was performed to collect 99 faecal samples, located in latrine sites founded through the rivers; 57 samples were collected in 2000 and 42 in 2007. We used 8 microsatellites to assess the genetic structure of the species in the area. Number of alleles per locus (A) found in the six rivers ranged from 3.25 – 4.50, with an average of 4.17. Expected heterozygosity (He) was 0.64 and observed heterozygosity (Ho) was 0.55. At the
population level, mean values of heterozygosity were similar in all rivers. Non genetic structure was observed due to the strong genetic flow between the main River and its tributaries. Effective number of migrants was smaller in 2000 compared with samples of 2007 (1.7 vs. 13.7, \( P<0.05 \)). When examining all rivers, most of the observed variability (94.07\% of total AMOVA variance) occurred within sites. Overall Fst estimate for the comparison was 0.002. Difference between samples obtained during both searching times is clear, resulting in a temporal variation in the allelic frequencies, as a reflection of the collecting techniques used and the samples collected. No significant effects from inbreeding were evident in our analysis, nevertheless a potential bottleneck affected population in the area, maybe as a result of the strong illegal hunting from 1950 to 1980.

187 A MULTILOCUS PERSPECTIVE ON THE HISTORY OF SHREW DIVERSIFICATION IN THE ISLANDS OF SE ASIA

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Island archipelagos, with their discrete nature and generally well-understood geological histories, offer a multitude of opportunities for studying the process of cladogenesis. Shrews of the genus *Crocidura* (Soricomorpha: Soricidae) are widespread among the islands of SE Asia and thus represent a model system for understanding the effects of geological and climatic history on the process of phylogenetic diversification. With an active field program in the Philippines and loans from numerous institutions, we have obtained over 200 specimens of *Crocidura* from 35 sites in the Philippines, Indonesia, Malaysia, Vietnam, and China. We use a phylogenetic analysis of mitochondrial and nuclear DNA sequences to infer relationships among species and populations, test for the monophyletic origins of shrews in the Philippines and Sulawesi, and explore rates of diversification in this group. The phylogenetic signature of multiple invasions is apparent in both the Philippines and Sulawesi. Patterns of diversity in the Philippines in part reflect the dynamics of Pleistocene climatic oscillations, though effects of deeper history (e.g., Miocene–Pliocene volcanic activity) are apparent.

188 EFFECTS OF SEX AND SEASON ON HOME RANGE SIZE OF ARIZONA GRAY SQUIRRELS (*SCIURUS ARIZONENSIS*)

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The Arizona gray squirrel (*Sciurus arizonensis*) is endemic to the mountain ranges of the Madrean Archipelago and found almost exclusively within Arizona. The species is offered protection throughout a portion of its range: the Catalina gray squirrel (*S. a. catalinae*) is considered a "sensitive" subspecies by the Coronado National Forest, and the species is listed as federally threatened in Sonora, Mexico, as a consequence of habitat loss. Despite a description 140 years ago, no information is available on this species in the literature. We used live-capture methods and telemetry to study a population of Arizona gray squirrels in the Huachuca Mountains of Arizona to investigate the influence of sex and season on home range size as part of a broader life history study. Home ranges sizes were large relative to most species of tree squirrel. Male home ranges tended to be larger than females, and season (breeding vs. non-breeding) affected home range size. Our results suggest that the scale of conservation efforts may need to be extensive and an important consideration in conservation planning for this uncommon species.
UNDERSTANDING WHITE-TAILED DEER PRODUCTIVITY: ECOLOGY OF NEONATES IN NORTH-CENTRAL SOUTH DAKOTA

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Knowledge of neonate mortality rates and habitat selection is critical to understanding how preseason mortality rates affect population viability of white-tailed deer (Odocoileus virginianus). Factors that can contribute to the vulnerability of white-tailed deer fawns to mortality include date of parturition, nutritional condition, disease, maternal age, dam-neonate behavior, predation, and habitat quality. During summer 2007, we captured 22 neonate white-tailed deer (14 females and 8 males). Mean age at capture was 5.4 days (SE = 0.81, n = 20), with mean handling time of 2.6 minutes (SE = 0.20, n = 20). Mean weight of neonates at capture was 3.92 kg (SE = 0.24, n = 20). During 21 capture events we noted 13 (61.9%) aggressive doe encounters including 5 (38.5%) aggressive encounters by year-old fawns. We monitored neonates twice daily for location and mortality for 3 months postcapture and 2 – 3 times weekly afterwards for a total of 1,798 locations. Home range size of neonates increased throughout the summer (P = 0.04) from 0.5 km² (SE = 0.09, n = 21) in June to 0.8 km² (SE = 0.14, n = 15) in August. Survival was high, with only 2 mortalities during the first 6 months. We documented a shift in neonate habitat use between early and late summer. Mean age at the time of the movement was 48.8 days (SE = 3.81, n = 17), with a mean date of movement of 12 July (range 26 June – 5 August). Utilization distribution overlap index of the 95% home range between early and late summer was 48%; however, overlap of the 50% home range was 14%. In early summer, grass (u = 1.25) was selected, but in late summer, corn (u = 1.33) was selected. These results indicate the possible impact on early neonate habitat use by the conversion of Cropland Reserve Program lands to row crops for biofuel production.

BIGHORN SHEEP LAMMING HABITAT IN THE NEBRASKA PINE RIDGE: DEVELOPMENT AND EVALUATION OF A GIS MODEL

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Lamming habitat may be critical to the survival of neonatal bighorn sheep, and may be limited for low-elevation populations. We studied parturition site selection by female bighorn sheep in a well-established, reintroduced population in Fort Robinson State Park in western Nebraska. Thirty-eight parturition sites of radiocollared bighorn sheep were located in 2002-2004. Habitat variables associated with parturition sites and with 39 points randomly generated within 300 m of escape terrain were measured at the site or extracted from a geographic information system. We used logistic regression to test a priori hypotheses of parturition site selection and an information-theoretic approach for model selection. We evaluated the resulting best model by using it to predict parturition sites used by a newly translocated population of bighorn sheep in an adjacent area of the Nebraska Pine Ridge. Average distance between parturition sites used in consecutive years by individual bighorn sheep was 1.84 ± 0.55 km. The model with the lowest AIC score contained only distance to 27° slopes. All competitive models (within 2 AIC) included distance to 27° slopes, with ruggedness, solar radiation index, distance to water, and visibility also appearing in different models. Twelve of fourteen parturition sites used by female bighorn sheep reintroduced into another part of the Nebraska Pine Ridge in 2005 occurred in areas identified as high probability of use for parturition by the model based only on distance to 27° slopes. Thus, while more complex models were competitive with this model, the advantages of a single-variable model, easily applied with readily available digital elevation models (DEMs), and with good predictive ability, facilitate its use as a management tool.
SEASONAL MOVEMENTS AND HOME RANGE USE BY FEMALE PRONGHORNS IN WESTERN SOUTH DAKOTA

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Seasonal movements by pronghorns (*Antilocapra americana*) within the eastern-most extension of sagebrush steppe communities is limited. Current hypotheses regarding movement patterns of pronghorn suggest they initiate seasonal movements in response to severe winter weather, snowfall patterns, spatial and temporal variations in forage abundance, and availability of water. From January 2002 to August 2005, we monitored movements of 76 adult (≥1.5 years) female pronghorns on two study areas (Harding and Fall River counties) in western South Dakota. We collected 8,750 visual locations, calculated 204 home ranges, and documented 19 seasonal movements. Eighty-four percent (n = 55) of pronghorns were nonmigratory and 10% (n = 6) were conditional migrators. Mean distance between summer and winter range was 23.1 km (SE = 2.8, n = 13). Four adult pronghorns (6%) dispersed a mean distance of 37.6 km (SE = 12.4); 1 female moved a straight-line distance of 75.0 km. Winter and summer home range use areas varied (P < 0.0001) between study sites. Mean 95% winter and summer home ranges of pronghorns were 55.5 and 19.7 km² in Harding County and 127.2 and 65.9 square km in Fall River County. Nonmigratory behavior exhibited by pronghorns was likely associated with minimal snow cover and moderate temperatures during winter 2002–2004. Variation in adult seasonal ranges between sites was likely associated with differences in forage distribution and availability between regions.

WINTER HABITAT SELECTION OF FREE RANGING ELK IN THE BRUCELLOSIS ENDEMIC AREA OF WYOMING WITH RESPECT TO HABITAT IMPROVEMENT AREAS IN THE BUFFALO VALLEY

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The supplemental winter feeding of elk in Wyoming is of great concern due to the increased potential for disease transmission at higher densities of elk. Greater prevalence of the disease in elk increases the potential for contact between infectious agents and domestic livestock. Among recommendations by the Wyoming Brucellosis Coordination Team was to continue projects aimed at improving native winter habitat for elk near established feedgrounds to reduce dependence on supplemental feed. The goal of this study is to assess winter habitat selection by a segment of the Jackson Elk Herd Unit in Buffalo Valley that is primarily free-ranging despite proximity of winter feedgrounds. During the winters of 2006 and 2007, 55 female elk were fitted with VHF or GPS collars and were located weekly in the field by triangulation, as well as every two hours by GPS. Canopy cover, forb and grass cover, and shrub density were estimated bimonthly, January-April, at 48 transects throughout the valley in habitat treatment areas of different ages and at random locations. Snow depth, snow crusting and snow water equivalent measurements were also collected on the transects to assess potential effects on elk movement. The two winter field seasons presented substantial differences in snow conditions and forage availability. Elk location data from VHF and GPS collars are currently being analyzed.
ANNUAL USE OF WATER SOURCES BY REINTRODUCED BIGHORN SHEEP: EFFECTS OF SEASON AND DROUGHT

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Water sources are important for the conservation and management of bighorn sheep (*Ovis canadensis*); however, little is known regarding the use of water by reintroduced Rocky Mountain bighorns (*O. c. canadensis*). Furthermore, riparian areas surrounding water can serve as transmission sites for parasitic lungworms to bighorns. Our objective was to quantify use of 7 water sources by bighorns using motion-sensor cameras on Antelope Island State Park, Utah, USA, from July 2005 to December 2006. We predicted that bighorns would increase the number and duration of visits to water during summer. Moreover, we predicted that animals would visit and spend more time at water during drought conditions. Our results indicate that bighorns visited and spent more time around water in summer. Furthermore, these animals did not visit and spend more time at water during drought conditions. Use of water sources, however, increased during times of similar precipitation that followed drought, indicating a time-lag in water use by bighorns. Our results underscore the importance of water sources for reintroduced bighorns in the deserts of the western USA, and indicate that animals congregate in riparian areas near water and thereby may facilitate the spreading of diseases and parasites.

AGE ANALYSIS AND POPULATION PARAMETERS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) ALONG COASTAL TEXAS: PRELIMINARY ANALYSES

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Terrestrial mammalian intrauterine life exhibits two distinct growth patterns, the non-linear relationship (embryonic) and the linear relationship (fetal). In general, terrestrial mammalian growth curves are constructed on a continuum of pre and postnatal life, which reflects mammalian growth. Early studies of terrestrial mammalian growth, invited marine mammal biologists to undertake similar studies of cetaceans to validate a unifying theme in mammalian growth patterns. However to date, cetacean growth studies have precluded the prenatal portion of the dataset, reducing the likelihood that these growth curves accurately depict growth among marine mammals. Length from stranding records and age determined by growth layer group analyses were collected from Texas coast bottlenose dolphins (*Tursiops truncatus*) (N=84). Length-at-age data was analyzed with a least squares Gompertz growth model (Adj. $R^2 = 0.84$). Preliminary analysis indicates maximal age to be 38 years. Mean length at birth for bottlenose dolphins along coastal Texas was determined to be 106 cm, which did not differ significantly from the previously reported value of 110 cm. In addition, preliminary, prenatal biparietal diameter data collected from ultrasonography (N=3) were linearly regressed against known gestational age (Adj. $R^2= 0.95$). Discrepancies in variation in among marine mammal growth curves could be reduced by combining the pre and postnatal data, as is commonly done in terrestrial mammalian growth modeling. The resulting complete pre and postnatal growth curve in bottlenose dolphins may support the hypothesis that a generalized mammalian growth pattern exists, regardless of habitat and phylogeny.

ECOLOGY OF A MESOCARNIVORE COMMUNITY IN PALO DURO CANYON

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Palo Duro Canyon cuts into the eastern escarpment of the Llano Estacado in the panhandle of Texas. Its rugged topography creates a regionally unique environment for mesocarnivores, yet little research has been conducted here. Our objectives were to initiate a survey of mesocarnivores in the canyon and examine habitat use by these species. Tomahawk live traps (91cm × 25cm × 30cm) were set in four habitats: parkland-mesquite savannah, escarpment, mixed brush woodland, and riparian. In 1,396 trap nights between October 2006 and November 2007 we captured 36 individuals of 4 species. Ringtails (Bassariscus astutus) were the most common species captured (1.15/100 trap nights), followed by raccoons (Procyon lotor; 1.00/100 trap nights), gray foxes (Urocyon cinereoargenteus; 0.36/100 trap nights) and feral cats (0.07/100 trap nights). Ringtails, gray foxes and feral cats were only captured in the escarpment habitat. Raccoons were captured most commonly in riparian areas (3.24/100 trap nights) followed by parkland-mesquite savannah (1.21/100 trap nights) and escarpment (0.65/100 trap nights) habitats. Our study has provided important information on mesocarnivores in a unique environment including confirmation of the presence of ringtails in Palo Duro Canyon.

197 USE AND PERSISTENCE OF PYGMY RABBIT BURROW SYSTEMS: SHIFTS ACROSS SPACE AND TIME

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Pygmy rabbits exhibit burrowing behaviors that are unique among North American lagomorphs. Although burrows represent an opportunity for monitoring changes in populations over time, an understanding of the dynamics of burrow use by this species is limited. We asked three questions about burrow use and persistence: 1) how are burrows distributed spatially; 2) does density and distribution of burrow systems differ between sites and across years; and 3) how do patterns of burrow occupancy change over time? We conducted burrow censuses at two sites in eastcentral Idaho during 2002-2007. Locations of burrows were recorded, and activity status was assessed based on integrity of burrow entrances and presence and appearance of fecal pellets. We examined spatial distribution of burrow systems within and between years using nearest-neighbor analyses. Density of active burrow systems ranged from 0.6/ha to >2.0/ha, and both density and proportion of burrows that were active differed between sites and across years. Burrow systems were closely associated with mima mounds, and although distribution of mima mounds was significantly dispersed relative to random, the distributions of active burrow systems were significantly clumped in all years at both sites. Individual burrow systems remained active for up to 6 years, which exceeds the life span of the species. Analyses of proximity of active burrow systems across years indicated that locations of active burrow systems shifted over time, and distributions differed significantly after 3-5 years. Because sagebrush is the primary food source for this species, we hypothesize that foraging behavior might affect sagebrush cover, contributing to shifts in burrow use over time.

198 AGE STRUCTURE, GROWTH, AND MORTALITY OF BELUGA IN THE CANADIAN ARCTIC: RESPONSES TO DIFFERENT ENVIRONMENT AND DENSITY?

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Environmental constraints on life history traits are expected to increase with seasonality in resources such as food and appropriate breeding habitat. Seasonality is highest at polar latitudes, and environmental constraints can be stronger than biotic factors, such as density and its effect on
Intraspecific competition. In this study, the age structure, body length distribution, mortality, and density were studied and compared between four beluga populations of the Canadian Arctic: Baffin Bay (BB), Cumberland Sound (CS), western (WHB) and eastern Hudson (EHB) Bay, to test the prediction that density-dependent effects on these life history traits should be inversely related to latitude. Growth, but not mortality, showed a significant positive relationship with latitude, and variation in density did not appear to be influential. Age distributions differed in their shape between populations, with animals caught at the highest latitude population (EBS) being the oldest and attaining the longest adult body lengths, compared to lower-latitude populations (WHB and EHB). Although differences in hunting selectivity and pressure may have played a role in the observed responses, the latitudinal variation in adult body size suggests that environmental seasonality may impose stronger constraints on life history traits of beluga with increasing latitude.

199 INTERACTIONS BETWEEN BISON, ELK, AND PLANT COMMUNITIES IN AN ONGOING TALLGRASS PRAIRIE RECONSTRUCTION EFFORT.

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Although fire is often incorporated into tallgrass prairie reconstructions, grazing by large, native herbivores typically is not. Little is known about how native grazers interact with plant communities during the reconstruction process, i.e. selection of plant communities in different stages of reconstruction, representation of plant species in diets, and effects of abiotic features on habitat selection. Lack of this knowledge prevents prediction of potential impacts of native herbivores on reconstruction efforts, as well as potential impacts of reconstruction activities on the ability of native grazers to meet energetic and nutritional requirements during the reconstruction process. In an effort to understand the impacts of native herbivores on tallgrass prairie reconstruction efforts we conducted a two-year (2006-07) diet and habitat selection study on reintroduced populations of elk (*Cervus elaphus*) and bison (*Bison bison*) at the Neal Smith National Wildlife Refuge in Prairie City, Iowa. This observational study included intensive surveys of native ungulate group locations throughout the summer seasons, estimation of percent cover of plant species in habitat patches, and collection of fecal samples for diet analysis. The elk population utilized tree areas and chose habitat on the basis of native plants, slope, aspect, and distance to fences. The bison population segregated into a bull bachelor group and a mixed group, containing cows, calves, yearlings, and bulls. The mixed group utilized recently burned areas and the bull groups used unburned areas. The bull group used native plants as a habitat selection factor. Most recent burns, native plants, slope, and aspect were important variables for habitat selection by the mixed group. Findings from this study will help illustrate benefits and challenges of incorporating native herbivores in tallgrass prairie reconstruction efforts, and therefore aid in future management plans in this greatly reduced ecosystem.

200 SPATIAL VARIATION IN POPULATION PERFORMANCE OF BLACK-TAILED PRAIRIE DOGS IN CHIHUAHUA, MEXICO

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Natural and human-induced changes occurring in grassland ecosystems of northwestern Chihuahua may have different impacts on prairie dog populations depending on the nature of disturbances. Whereas patchy distribution of resources may create local dynamics in adjacent subpopulations, landscape structure may contribute to shape local population dynamics through indirect effects of habitat patch size and isolation. In this study, we analyzed the influence of local and landscape factors, both natural and anthropogenic, on population performance of multiple black-tailed prairie dog subpopulations in northwestern Chihuahua. We monitored prairie dog population density and juvenile production in 45 plots scattered across the entire colony complex between 2005 and 2007. Local environmental variables were simultaneously sampled to describe forage availability, visual obstruction, incidence of cattle and predator abundance. Landscape variables were measured over
digital maps to describe colony size and isolation degree, distance to edge and proximity to human features. Total density, juvenile-to-adult ratio, and rate of population change were used as surrogates of population performance. We found that population density was best modeled by colony size (negative effects), area covered by hostile habitat within 1 km (positive), cover of unsuitable vegetation during the dry season (negative), and cover of forbs during the dry season (positive). In contrast, juvenile production and population rate of change were best explained only by local habitat variables: cover of grasses and forbs during the rain season (positive effects), and cover of grasses and forbs during the previous-year rain season (negative effects). These results suggest that prairie dogs attain higher densities in landscapes that reduce dispersal rates, and seem to reproduce more in areas with high food availability during the reproductive season but with low plant production during the peak of plant productivity.

200b QUANTITATIVE ANALYSES TO DETERMINE OPTIMUM CONSERVATION OPTIONS FOR THE RIGHT WHALE (EUBALAENA GLACIALIS) IN TWO CRITICAL FEEDING HABITATS

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The North Atlantic right whale is endangered, in part, due to vessel-strike mortality. On a per-capita basis the right whale is more prone to be reported as struck by vessels than other large whale. Vessel and right whale survey data are used to quantify the risk of lethal vessel encounter by using two estimates: (1) the event – the probability of a vessel encountering a right whale, and (2) the consequence – the probability of a lethal injury given an encounter. Analyses of vessel-strike data, using vessel speed as a predictor of lethality, demonstrate that only below 11.8 knots does the probability of lethal injury fall below 50%. In the Bay of Fundy the risk estimates of lethal collision were reduced by 62% by means of an amendment to the traffic separation scheme (TSS) that intersects a Right Whale Conservation Area. In Roseway Basin on the Scotian Shelf, most vessels navigate outside a Right Whale Conservation Area, although the highest risk is concentrated within the Conservation Area where fewer vessels navigate at greater speed. These estimates contributed to the International Maritime Organization adoption of a TSS amendment in the Bay of Fundy and an area to be avoided (ATBA) on the Scotian Shelf. Thus, the greatest reduction in the risk of lethal vessel-encounters with whales, balanced by some minimal disruption to vessel operations while maintaining safe navigation, can be achieved. A new study designed to accurately quantify the efficacy of the ATBA in reducing vessel-risk to whales is summarized.

201 EVOLUTIONARY HISTORY OF THE GENUS CORYNORHINUS

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The notoriously fragmented nature of the chiropteran fossil record has made it extremely difficult to resolve issues of evolutionary history based solely on morphological data. For big-eared bats of the genus Corynorhinus, recent molecular work has answered many questions regarding phylogenetic relationships, but placing estimates on dates of divergence for taxa within the genus as well as developing a reliable calibration for a molecular clock has been problematic due to a deficiency in reliable fossil calibration points and a lack of statistical power in the analyses available. However, with the advancement of Bayesian and coalescent-based statistical approaches and relaxed molecular clock models, obtaining reliable divergence dates when faced with uncertainty in molecular clock calibrations has become possible. We obtained mitochondrial DNA
sequence data from the control region of *C. rafinesquii*, *C. mexicanus*, and the five recognized subspecies of *C. townsendii* and employed a coalescent-based approach combined with a relaxed molecular clock model to test competing hypotheses of evolution for big-eared bats in North America: 1) late Pleistocene vs. early Holocene divergence among subspecies of *C. townsendii*; 2) Pliocene vs. Pleistocene interspecific divergence among North American big-eared bats.

203 RESOLVING CONFLICTS BETWEEN MORPHOLOGICAL AND MITOCHONDRIAL DNA DATA SETS IN *MYOTIS* BATS

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The California myotis (*Myotis californicus*) and the Western small-footed myotis (*Myotis ciliolabrum*) are largely sympatric in the western United States, and are so morphologically similar that subtle features of their skull must be used to distinguish between them. Previous analysis of mitochondrial DNA (mtDNA) sequence data demonstrated that these two species are paraphyletic. The objective of this study was to use a DNA fingerprinting technique, amplified fragment length polymorphism (AFLP), to resolve the conflicting morphological and mtDNA data sets. We analyzed 152 loci from 17 *M. californicus*, 16 *M. ciliolabrum*, and 7 *M. leibii* using principle coordinate and parsimony analysis. Eighteen specimens were common to both the mtDNA and the AFLP study. Preliminary results recovered a well supported separation of *M. ciliolabrum* and *M. californicus* based on these nuclear markers and suggest that the failure of the cytochrome b gene tree to recover monophyletic lineages is due to lack of lineage sorting or mitochondrial introgression between *M. ciliolabrum* and *M. californicus*. Unexpectedly, *M. leibii* individuals from the eastern United States and Canada clustered closely with *M. ciliolabrum*. Analysis of genetic structure using STRUCTURE 2.2 assigned *M. leibii* and *M. ciliolabrum* individuals to the same population. This result is congruent with a Mantel test that showed a correlation between genetic and geographic distances and suggests all small-footed bats in North America are acting as a single species.

204 REEVALUATION OF THE TRIBE PLECOTINI BASED ON MITOCHONDRIAL AND NUCLEAR SEQUENCE DATA

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Presently, 16 recognized species in six genera (*Barbastella*, *Corynorhinus*, *Euderma*, *Idionycteris*, *Otonycteris*, *Plecotus*) constitute the Holarctic tribe Plecotini (Vespertilionidae: Vespertilioninae). Over the last century debate has surrounded the taxonomic validity of this tribe, its composition and position within Vespertilioninae, and the position and rank of its members. Previous studies have reexamined Plecotini taxonomy by incorporating new morphologic and karyotypic data into previous data sets with conflicting results. Furthermore, these studies have assumed monophyly of Plecotini. Recent studies of mitochondrial sequence data were the first to test Plecotini monophyly but were unable to resolve relationships within the tribe and provided only moderate support for monophyly (excluding *Otonycteris*). In this study we use nine genetic markers, comprising over seven kilo-bases of aligned sequence data including mitochondrial, coding, and non-coding nuclear DNA to provide greater resolution in testing questions of Plecotini monophyly and intra-tribal relationships. Using maximum parsimony, minimum evolution, maximum likelihood, and Bayesian analysis methods we generated supported phylogenies based on both marker-specific and combined data sets.
205 MITOCHONDRIAL DNA, KARYOTYPES, AND MORPHOLOGY OF MALAYSIAN WOOLLY BATS (GENUS: *KERIVOULA*)

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Studies on the genus *Kerivoula* of the Indomalayan region are limited and have mainly focused on the distribution and ecology rather than systematics. In 2006, we collected 20 specimens of *Kerivoula* from Malaysia, representing at least three species: *K. intermedia*, *K. papillosa*, and *K. pellucida*. Subsequent phylogenetic analyses using mitochondrial gene sequence data revealed six statistically supported monophyletic clades. Cytochrome-**b** genetic divergences ranged from 10.85% to 20.29% between clades, whereas within clades variation ranged from 0% to 4.44%. Using comparisons of cranio-dental morphology and original descriptions that are the basis of specific level names, clades were assigned to *K. hardwickii*, *K. intermedia*, *K. lenis*, *K. minuta*, *K. papillosa*, and *K. pellucida*. Karyotypes were used to further document genetic variability among these six putative species. Five different karyotypes were identified, but representative of two clades had indistinguishable karyotypes. Genetic data from this study indicate that time since common ancestry for Malaysian *Kerivoula* species is quite old and higher than those typical for congenerics. Our data support previous findings that cladogenic events distinguishing allopatric genetic lineages recognized as species occurred in the Sundaland landmasses over 1 Mya involving the Pleistocene to the Pliocene epoch. This study indicated that the combined application of genetic divergence, morphology and unique karyotypes are valuable resources to phylogenetically identify species boundaries and to substantiate the presence of unrecognized biodiversity for *Kerivoula*. Level of variation found within two conspecific populations studied here suggests there are more species to be discovered in South East Asia.

206 GENETIC VARIATION AND STRUCTURE IN THE ENDANGERED MEXICAN LONG-NOSED BAT (*LEPTONYCTERIS NIVALIS*): MITOCHONDRIAL AND NUCLEAR PERSPECTIVES

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The endangered Mexican long-nosed bat (*Leptonycteris nivalis*) is a nectar-feeding phyllostomid that occurs in high-elevation, semi-arid, pine-oak woodlands of central and northern Mexico and two localities within the southwestern United States. Female *L. nivalis* migrate during summer; they follow blooms of paniculate *Agave spp* to the northern reaches of their distribution where parturition occurs. This species is thought to have experienced recent declines. However, evidence on the trends of *L. nivalis* numbers is scant and little is known about its migratory patterns. We collected wing punch tissue samples from *L. nivalis* throughout its range. Genetic analysis of mitochondrial DNA (Control Region) and nuclear DNA (Amplified Fragment Length Polymorphisms) revealed an absence of genetic structuring within *L. nivalis*. Nucleotide ($\pi = 0.013$) and haplotype ($h = 0.810$) diversity values for genetic data are comparable to other species of migratory bats, and were moderately high for a species believed to have undergone a recent, drastic decline. Patterns of mtDNA sequence variation (Tajima’s $D = -1.054$; $P > 0.10$, Fu’s $F' = 16.53$, and mismatch distribution) and a star-like AFLP neighbor-joining tree topology suggest a historic population expansion. The geographic distribution of mtDNA control region haplotypes does not support the hypothesis of female philopatry.
In addition, direct evidence of movement was observed by the recapture of individuals with wing punches, providing further support against philopatry in L. nivalis. Population size was estimated based on mark-recapture data; these estimates, for migratory females and their offspring, were comparable to cave exit counts at Emory Cave from previous studies, suggesting that all reproductive L. nivalis females may migrate as a single colony. If this is the case, then L. nivalis, as a species, would be extremely vulnerable to disturbance at any one roost along their migratory route.

207 TESTING YELLOWSTONE NATIONAL PARK’S MULTIGENERATIONAL LARGE-MAMMAL DEATH ASSEMBLAGE AS A SOURCE OF HISTORICAL AND CONTEMPORARY DATA ON UNGULATE HABITAT UTILIZATION

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Mammal bones accumulate on landscape surfaces over multiple generations and these assemblages contain historical ecological data that reveal habitat utilization patterns useful for augmenting ecological surveys – particularly for areas where long-term biomonitoring efforts have been inconsistent or lacking. Because the likelihood of death at a given location varies across a species’ geographic range (as a function of habitat use and the probability of death by predation or other means), patterns of skeletal accumulation are biologically informative. For example, calving grounds (a biologically critical habitat) may have anomalously high probabilities of death resulting in high bone concentrations. In addition, as surficial bone assemblages accumulate over multiple generations, if probabilities of death within the geographic range change due to altered biotic or abiotic factors, the skeletal remains may capture those temporal trends. Here I test the sensitivity of bone records to provide data on habitat and geographic utilization by comparing home range data on the well-studied Yellowstone ungulate community with bone surveys of forty, 1km transects in four habitats (rolling grasslands, forests, river margins, and lake margins) across the Northern Range of Yellowstone National Park. I also test the sensitivity of bone records to capture changes in elk habitat use resulting from a known perturbation (1995 wolf reintroduction). Anomalously high concentrations of neonatal and juvenile bones faithfully record ungulate calving grounds. In addition, areas with high antler concentrations coincide with male elk wintering grounds. By calibrating physical characteristics of bone decomposition to decay rates, cohorts of death are recognized across the Northern Range and show changes in patterns of the geographic distributions of elk deaths over the past few decades – portraying changes in interactions between elk, their habitat utilization, and carnivore activity.

208 NEUROBIOLOGY OF SOCIALITY IN TUCO-TUCOS (RODENTIA: CTENOMYIDAE)

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The social environment in which an animal lives may be reflected in its neurobiology, including the prevalence and distribution of neuropeptide receptors in the brain. While the neuropeptides oxytocin and vasopressin have been implicated in aspects of social behavior such as reproductive pair bond formation and parental care, little is known regarding the neurobiology of other types of social relationships. To explore the possible roles of oxytocin and vasopressin in the formation of social relationships within female kin groups, we examined the distributions of the receptors for these neuropeptides in two syntopic but behaviorally distinct species of tuco-tucos from southwestern Argentina. The colonial tuco-tuco (Ctenomys sociabilis) is social; burrow systems of this species are routinely inhabited by multiple closely related adult females. In contrast, the Patagonian tuco-tuco (C. haigi) is solitary, with never more than one adult per burrow system. Autoradiographic analyses of the forebrains of these congeners revealed marked interspecific differences in the distributions of oxytocin (OT) and vasopression (V1a) receptors. The distribution of OT receptors in C.
sociabilis differs from that reported for socially monogamous voles and mice, suggesting that female kin relationships are neurobiologically distinct from reproductive pair bonds. Currently, we are expanding the taxonomic coverage of these analyses to examine differences in receptor binding distributions among ctenomyids in a broader comparative and phylogenetic context.

209 SHARING OF ABOVEGROUND AND UNDERGROUND SPACE BY ADULT FEMALE RICHARDSON'S GROUND SQUIRRELS

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Hibernating species of ground-dwelling squirrels spend >75% of their lifetime underground, sleeping or hibernating, but most studies of social behaviour focus on the 20-25% of their lives that is spent aboveground. Those studies reveal that adult female kin typically live in proximity and are more tolerant of each other than non-kin. We used radiotelemetry to locate female Richardson’s ground squirrels in sleep sites and litter-rearing sites during the active season to determine whether tolerance among kin extends to sharing of underground space. Although all adult females reared the litter alone in chambers located in different burrow systems, most females shared sleep sites with close kin (littermate sisters, non-littermate sisters, daughters, granddaughters, nieces) between emergence from hibernation and mid-pregnancy. Some adult female kin resumed sharing of underground space in the prehibernation period after their litters were weaned. Thus, despite the characterization of Richardson’s ground squirrels as only moderately social, females form lifelong bonds and frequently share both aboveground and underground space.

210 INFLUENCE OF INTR-SPECIFIC COMPETITION AND INDIRECT PREDATION RISK ON THE FORAGING BEHAVIOR OF WHITE-FOOTED MICE

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An animal behaving optimally should allocate time between foraging and non-foraging activities in a way that maximizes fitness. Predation risk and intra-specific competition are factors that can influence foraging behavior. Under high levels of predation risk, prey must increase vigilance and may shift their foraging among microhabitats. To test the influence of predation risk, competition, and microhabitat selection on the foraging behavior of white-footed mice (Peromyscus leucopus), giving up densities (GUD) and population densities were measured for one year. The objectives of this study were to estimate the levels of intra-specific competition among seasons and to determine the amount of foraging occurring in four microhabitats by white-footed mice under predation risk. Predation risk was simulated using coyote (Canis latrans) urine and great-horned owl (Bubo virginianus) calls and models. A 1.44-ha plot was live-trapped 1 time each season for 6 nights during a new moon. A total of 24 foraging stations were established around the periphery of the plot with each station containing trays at four different microhabitats: base of a tree, 2 m away from a tree, adjacent to a log, and 2 m above the ground. Each tray contained 10 g of millet seed mixed with 2 L of sand. Trays were checked for four consecutive days once each season for both predator treatments. White-footed mouse densities were lowest during the winter and spring and much higher during summer and fall. There were few significant effects on white-footed mouse GUD when using coyote olfactory cues, the exceptions being a significant time effect and a predator effect over time. There was a significant main effect along with effects of time, predator treatment, and microhabitat interactions on GUD when using owl cues. The significant effects were most likely due to intra-specific competition because of fluctuations in the population density of white-footed mice, and not to coyote or great-horned owl cues.
DOES KINSHIP EXPLAIN VARIATION OF CONTACT RATES AND DEN SHARING OF AN URBAN CARNIVORE, THE RACCOON?

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As typical of many so-called 'solitary' carnivores, several aspects of the raccoon's (Procyon lotor) social system are poorly understood. We monitored a high-density population of raccoons to elucidate their social system in suburban Chicago from 2004-2006. Our objectives were to: decipher if related individuals exhibited greater contact rates than unrelated individuals, examine if high rates of contact were more persistent throughout the year for related than unrelated raccoons, and assess if den cohabitation was reserved for related same-sex pairs, or unrelated male-female (MF) pairs. Most, if not all, adults (n=42) within the population were equipped with proximity detecting radio collars to quantify the frequencies and durations of contacts between individuals. Additionally, we analyzed blood samples collected from collared individuals using 16 highly variable microsatellite loci. Genotypes were analyzed by Kinship 1.2 using 10,000 simulations to obtain an unbiased estimate of pair wise relatedness. Using a series of 2-sample permutation tests, we did not find that related individuals were more social than unrelated individuals (all P-values > 0.044, bonferroni correction). Of the 11 male-male (MM) dyads with high contact rates, 8 (72.7%) were negatively related. Relatedness did not explain high contact rates between female-female (FF) dyads either as nearly half (44.4%, n=9) of the most social dyads were negatively related. Similarly for MF pairs, nearly half (47.3%, n=19) of the most social dyads were negatively related. Social associations between individuals were longer lasting in MM dyads than FF or MF dyads. Den sharing was not confined to highly related dyads, or in the case of MF den sharing during the breeding season, reserved for negatively related dyads. These results indicate that genetic relatedness cannot solely explain the formation and variation of social associations of adult raccoons.

EVALUATION OF AN AUGMENTATION OF BIGHORN SHEEP AT BADLANDS NATIONAL PARK, SOUTH DAKOTA

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Rocky Mountain bighorn sheep (O. canadensis canadensis) were reintroduced to Badlands National Park (BNP) in 1964, representing the eastern most extent of the species’ current and historic range. In September 2004, 23 bighorn sheep were captured at Wheeler Peak, New Mexico and released at BNP to augment the existing population of approximately 68 individuals. Because it has been recommended that introduced populations are regularly monitored to evaluate the success or failure of transplants, the objectives of this study were to: 1) document survivorship, natality, dispersal, and recruitment of introduced bighorn sheep females and their offspring, 2) estimate 95% and 50% adaptive kernel planimetric and surface area home ranges of introduced bighorn sheep females, 2) determine habitat selection of introduced bighorn sheep females, 4) compare home range size and habitat selection of introduced to resident bighorn sheep females. Eighteen of 23 introduced bighorn sheep survived/remained with the sub-population. In 2005 and 2006, the 3 month-old lamb to adult ewe ratios were 90:100 and 62:100, respectively. In June 2006, 9 of 9 surviving yearling lambs dispersed from BNP with dispersal distances ranging from 43 to 524 km. In May 2007, 3 of 8 surviving yearling lambs dispersed from BNP with a dispersal distance of 25 km. The 95% adaptive kernel
and surface area estimates of the introduced bighorns decreased between years, but core home range size did not differ between years. The 95% and 50% adaptive kernel planimetric and surface area home range estimates were greater in resident than introduced sheep. Introduced and resident bighorn sheep differed in their use of habitat with introduced sheep selecting areas closer to roads, human use areas, and water. We propose that differences observed between introduced and resident bighorns may be due in part to the acclimation of the introduced sheep to the presence of humans in their former range.

211c CENTRAL-PLACE FORAGING OF FLORIDA MANATEES OVERWINTERING AT A THERMAL REFUGE

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In winter, Florida manatees are central-place foragers, seeking shelter from cold at a limited number of warm-water aggregation sites, mostly power plant effluents and natural springs. We investigated manatee foraging movements and attendance patterns at industrial thermal refugia in Tampa Bay in relation to environmental factors. We tagged and tracked 32 manatees over four winters (Dec-Feb, 2002-2006) using Argos-linked GPS tags that provided locations at intervals of 15-20 minutes. Temperature loggers provided data on ambient and refuge water temperatures, and on the thermal regime experienced by the animals. Tagged manatees spent a mean of 46.6% (SD=8.9) of their time in the heated discharge canal of power plants, where they fasted for up to 7+ consecutive days. Manatees made regular foraging excursions to seagrass beds within 45 km of the refuge, but trip distance was not correlated with temperature. Manatees spent a mean of 5.8 hr/day in mapped seagrass beds. Duration of excursions from the refuge was positively correlated with ambient water temperature, but trips were not timed to take best advantage of hourly variation in temperature. Manatees exhibited a strong pattern of nocturnal foraging activity, moving inshore to feed during nighttime high tides and returning to the power plant to rest during mid-day. The timing of foraging on seagrass was influenced by the interaction of tidal fluctuations in water level, bathymetry, and time of day. Access to shallow, nearshore grass beds was limited to times of higher water levels, which typically occurred at night during winter. Manatees avoided foraging during the day over extensive shallow grass flats, even when water levels permitted access. This may reflect their reluctance to stray from deeper water to which they flee when threatened by approaching watercraft. Winter attendance patterns and movements reflect the energetic tradeoffs manatees make between foraging in cold water and fasting in warm water.

212 THE ROLE OF LANDSCAPE BARRIERS, PATHOGEN EVOLUTION AND HOST ECOLOGY IN RABIES EMERGENCE

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Landscape features can facilitate or constrain the spread of disease. We compared viral evolution, host ecology, and the ability of rabies virus cross major river systems in two evolutionarily independent strains of rabies that infect the same host, the striped skunk (Mephitis mephitis). The North-Central rabies strain had more than a two-fold higher level of purifying selection than the South-Central strain (North dN/dS = 0.26; South dN/dS = 0.10), suggesting that the South-Central strain is under more stabilizing selection pressure.
Viral isolates of the South-Central infected twice as many skunks as the North-central strain (2.2 vs. 1.1 skunks/isolate), and demographic analysis of the number of viral infections indicated that the South-Central strain rapidly increased in population size, while the North Central strain maintained a constant population size. In striped skunk populations, high migration rates ($F_{ST} = 0.006; Nm = 41$ individuals per generation) suggest that in the Midwest rivers do not pose barriers to host dispersal. North- and South-Central rabies strains had differential success in crossing rivers. Phylogeographic analysis indicated that the North-Central strain crossed the Missouri River on 3 occasions, however the South-Central strain has yet to cross the Missouri River despite being present in border counties. The South-Central strain breached the Platte River only once to occupy northeast Nebraska. The evolutionary history of a virus may affect the way in which it emerges on the landscape. As such, different management approaches to intervention may be needed to effectively control these strains. We recommend that the North-Central and South-Central variants of skunk rabies be treated and managed as separate epizootiological events.

213 FLEA ABUNDANCE AND DISTRIBUTION ON MICE AT FORT CARSON MILITARY RESERVATION, COLORADO

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In May and June 2007, 378 fleas were collected from 547 small mammals in two physiographic provinces, the Great Plains (east) and the Rocky Mountain (west), of the Niobrara Chalk Barrens on the Fort Carson Military Reservation, Colorado. These provinces are one-seed juniper (Juniperus monosperma) woodland communities that support populations of piñon mice, (Peromyscus truei), deer mice (P. maniculatus), white-footed mice (P. leucopus), brush mice (P. boylii), silky pocket mice (Perognathus flavus), Mexican woodrat (Neotoma mexicana) and Colorado chipmunk (Tamias quadrivittatus). 69% of the total captures occurred on the east side and 30.7% on the west side of the reservation. In study plots on both east and west sides, P. truei was the most abundant (55% E, 62.4% W) mammal captured, followed by P. maniculatus (37.3% E, 33.3% W) and P. leucopus (7.7% E, 4.3% W). We examined the relative density, mean intensity and flea infestation rates between the east and west side plots for P. truei, P. leucopus and P. maniculatus. Although P. truei comprised the majority of the mouse hosts on both east and west sides, 55% and 62.4% respectively, the greatest relative density of fleas (48.9% E, 53.2% W) occurred on P. maniculatus. The flea Aetheca wagneri showed higher infestation rates than Orchopeus leucopus for all mice from both the east and west side plots. In addition, an individual Meringis parkeri was found on a P. maniculatus from a plot on the east side. The data showed differences in the examined parameters, between the east and west side plots for P. truei and P. maniculatus but not for P. leucopus.

215 MOLECULAR SYSTEMATICS AND HISTORICAL DEMOGRAPHY OF GRAY WHALE LICE: WHAT CAN THEY TELL US ABOUT GRAY WHALES?

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Gray whales (Eschrichtius robustus) are living islands to a diverse assemblage of crustacean ectoparasites that includes at least three species of highly specialized whale lice (Cyamus spp.). These lice are obligate parasites that undergo direct development on the gray whale host, and are dependent on direct physical contact to colonize a new host whale. Given their high degree of morphological specialization and obligate relationship with whales, whale lice might be expected to have a close, long-term evolutionary association with the gray whale. Such a relationship can lead to a parasite phylogeny that closely mirrors that of its host and a highly correlated demographic history between the
host and its parasites. Here we use a 738 base pair fragment of the mitochondrial DNA (mtDNA) Cytochrome C oxidase subunit I gene (CO I) gene to: (1) examine the phylogenetic relationships among, and genetic diversity within, gray whale lice (C. scammoni, C. kessleri, and C. ceti); and (2) infer historical demographic patterns within each species of whale louse. Whale lice samples were collected from five different gray whale hosts. Gray whale lice exhibited relatively high levels of genetic diversity suggesting large effective population sizes and gene flow among different gray whale hosts. Each species of louse was phylogenetically distinct and reciprocally monophyletic, indicating congruence between morphological and mtDNA phylogenies. The phylogeny also suggests that collectively these whale lice do not form a monophyletic group, supporting the hypothesis of independent colonizations onto the gray whale host. The polyphyletic relationships of gray whale lice provide three independent replicates for indirectly examining the demographic histories of their host, the gray whale.

216 PREVALENCE OF PARASITES INCLUDING STRONGYLOIDES ROBUSTUS IN THE STATE ENDANGERED NORTHERN FLYING SQUIRREL (GLAUCOMYS SABRINUS) AND CO-OCCURRING SOUTHERN FLYING SQUIRREL (G VOLANS) IN PENNSYLVANIA

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Strongyloides robustus is an intestinal parasite in both North American species of flying squirrel, Glaucomys sabrinus (Northern) and Glaucomys volans (Southern). Both species of the flying squirrel are found co-occurring in habitat in Pennsylvania. The population of the northern flying squirrel is declining and was listed as endangered by the Pennsylvania Game Commission in November 2007. Conversely, the population of southern flying squirrels has not declined in the state. We are investigating the potential role of the intestinal parasite, Strongyloides robustus on the decline of the northern flying squirrel. In 2007, we used the Sheather’s flotation technique to examine fecal samples from 8 northern flying squirrels and 14 southern flying squirrels collected from study areas in northeastern Pennsylvania. To date, we have found S. robustus in 2 northern flying squirrels (25%) and 5 southern flying squirrels (36%). We conclude, therefore, that the potential exists for parasite transmission between the two species and this parasite may be contributing to the decline of the northern flying squirrel. We also will present our findings regarding the prevalence of other internal parasites in co-occurring northern and southern flying squirrels.

217 MALES SEEKING FEMALES: ANOMALOUS SEX-RATIO BIAS IN BAT PARASITES (DIPTERA: STREBLIDAE)

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Ectoparasitic insects often exhibit female-biased sex ratios, a pattern usually explained by greater female longevity and that smaller, more active males are more likely to disperse or be groomed off the host. Theory predicts that unbalanced sex ratios should favor males when resources are abundant and predictable, and when males are the dispersing sex. Sex ratios of streblid bat flies were evaluated based on a large biodiversity survey in Venezuela—more than 25,000 bats representing 130 species were searched for flies, yielding more than 36,500 bat flies of 116 species. These samples allowed us to analyze sex ratios in 112 bat fly metapopulations. Our results indicate that fully one-third of these metapopulations were significantly male-biased. Traditional explanations for sex-ratio bias, such as sampling effects, unequal longevity between the sexes, and differential dispersal capability are refuted for bat flies in favor of an alternative hypothesis - selective host grooming. Because host grooming is the principal cause of mortality for these slow-reproducing
parasites, and because females are larger than males and gravid for a significant portion of their adult life, host grooming activity is more likely to kill or remove females than males.

218 SOUTHERN FLYING SQUIRRELS (*GLAUCOMYS VOLANS*) AS RESERVOIRS FOR SYLVATIC EPIDEMIC TYPHUS IN THE UNITED STATES: RECENT FINDINGS

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*Glaucomys volans*, the southern flying squirrel, remains the only known sylvatic reservoir for *Rickettsia prowazekii*, the pathogen responsible for sylvatic epidemic typhus. The mechanisms for transmission of disease to humans are not well understood. Human cases of disease are sporadically reported throughout the range of this small mammal following human cohabitation or contact with animals and nesting sites. In 2002 and 2007, *R. prowazekii* infections were serologically confirmed in two workers in a small office building adjacent to a heavily wooded area in central Georgia. Flying squirrels and nests had been reported in the walls of the office building, and the high attack rate (2 of 8 workers) suggested a focal area of high risk for pathogen transmission. Efforts to eliminate flying squirrels yielded two animals identified as *G. volans*. Brain tissue from one squirrel was PCR positive for DNA of typhus group rickettsiae. Only 1-2 cases are reported per year to the CDC, although it is presumed that such cases may occur and go undiagnosed due to the nonspecific clinical presentation of infection, the unfamiliarity of most physicians with this pathogen and its link to flying squirrels, and the lack of requirement for mandatory reporting. Including these two patients, 46 cases of sylvatic epidemic typhus are known to have occurred in the United States from 1976-2007. Among 26 well-documented cases over the past 3 decades, 14 persons resided or worked in buildings with flying squirrel infestations in the attics or walls, indicating that this may be an important risk factor for infection. To date, no cases of epidemic typhus have been reported to CDC with epidemiologic links to animal trapping or research studies, despite the risks for animal contact inherent in these activities. It is also possible that low-level exposures to *R. prowazekii* among persons that regularly handle flying squirrels could result in mild or asymptomatic infection, or may stimulate immunity against re-infection.

219 GENETIC STRUCTURE OF BLACK HILLS COUGARS

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Assessing genetic structure of free-ranging wildlife species can provide knowledge of population demographics that can supplement field data, which can be important for large carnivores that typically have relatively low densities across the landscape. Previous research on genetic structure of cougars indicated that movement occurred between most western cougar populations despite barriers (both habitat and human caused) that could potentially isolate populations. We assessed the genetic structure of a cougar population in the Black Hills of South Dakota and Wyoming, which was nearly if not entirely extirpated from the region in the early to mid 1990’s. In addition to evaluating genetic structure, we conducted population assignment tests with nearby cougar populations (North Dakota and Wyoming) based on 20 microsatellite loci. We conducted genetic analyses on 134 cougars from
the Black Hills along with 18 cougars from North Dakota. Although Black Hills cougars showed a marginally significant genetic bottleneck, they do not appear to have any deleterious effects from the event. South Dakota cougars had an average observed heterozygosity (H₀) of 0.547, which was similar to other cougar populations. We were able to successfully assign cougars from South Dakota and North Dakota into separate populations based on data obtained from 20 loci.

220 RESOURCE SELECTION BY BLACK-FOOTED FERRETS IN SOUTH DAKOTA AND MONTANA

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A thorough understanding of resource selection is critical to assessing and managing habitat for the recovery of endangered species. The black-footed ferret (Mustela nigripes), once extinct in the wild, remains one of the most critically endangered mammals in North America despite 15 years of reintroduction attempts. We monitored ferret space use at 2 reintroduction sites, 1 in South Dakota and 1 in Montana, and related space use to resource attributes. Using an information-theoretic framework, we developed and tested hypotheses about ferret resource selection as it relates to black-tailed prairie dog (Cynomys ludovicianus) burrow distribution, ferret space-use sharing and habitat edge effects. We found some support for all 3 hypotheses, but the spatial distribution of prairie dog burrows consistently was the most important factor in ferret resource selection at both sites. Our findings support the hypothesis that ferrets select for areas of high prairie dog burrow density. Furthermore, ferrets are more likely to overlap in their use of space when areas of high prairie dog burrow density are available. Thus, management strategies that focus on monitoring, preserving and enhancing areas of high prairie dog density will likely contribute to ferret reintroduction success.

221 EASTERN SPOTTED SKUNK (SPIOGALE PUTORIUS) DENNING AND RESTING ECOSYSTEM

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Sites used for denning and resting are important ecological components for carnivores. We investigated summer resting and den site selection by a radiocollared population of eastern spotted skunks (Spilogale putorius) in the Ouachita Mountains of western Arkansas, USA from May through August 2005 and 2006. We identified and characterized microhabitat and landscape characteristics of 127 den and resting sites used by 13 eastern spotted skunks. Sites were located in burrows excavated by other mammal species (48%), in decayed or burned root systems (22%), in rocky outcrops (14%), in eastern woodrat (Neotoma floridana) nests (9%), or in ground level tree or log cavities (7%). Reuse of sites was common, but communal use of sites was rare. We contrasted both used dens and resting sites to putatively available but unused nearby sites and used an information-theoretic approach and discrete choice analysis to contrast support for several
hypotheses potentially underlying resting and den site selection. We found support for thermal regulation and predator avoidance as influencing den site selection. We also conducted a second analysis to create a best-fit model for resting and den site selection. Sites were selected based on increased vegetative cover, with canopy closure being the most important factor influencing resting and den site selection. Higher rock and vine densities, younger pine forest stands, older hardwood stands, steeper slope, and smaller site entrance also positively influenced resting and den site selection. These findings suggest that eastern spotted skunks select structurally complex sites, likely to enhance protection from predators. Eastern spotted skunks may thus be vulnerable to habitat alterations that reduce this structural complexity.

### 222 AMERICAN MARTEN SURVIVAL IN NORTHERN WISCONSIN

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American martens (*Martes americana*) remain endangered in Wisconsin despite several reintroductions. Marten populations have not increased and remain localized near reintroduction sites. Marten habitat preference and home range size has been described in Wisconsin, but demography estimates have not been reported. We estimated marten survival for the summer/fall (July 16 to November 15), winter (November 16 to March 15), and kit-rearing (March 16 to July 15) periods using data collected on and near the Chequamegon-Nicolet National Forest in northern Wisconsin between 1993 and 2006. Fishers (*Martes pennanti*) and raptors each accounted for a minimum of 36% of marten mortalities. Incidental harvest accounted for 9% of mortalities and remaining causes of mortality (18%) were not identified. Survival estimates calculated across sex- and age-classes were highest during summer/fall (0.98; 95% CI 0.93-1.02), lower during the kit-rearing period (0.91; 95% CI 0.84-0.98), and lowest during winter (0.83; 95% CI 0.72-0.93). Annual survival was 73%. Male survival was lower during summer/fall (P < 0.001) and higher during winter (P = 0.006) than female survival. Juvenile survival during winter was high (1.00) for 4 juveniles, but was inestimable for other periods. Our marten survival estimates were similar to estimates calculated for non-trapping periods in other areas of the marten range. Unlike other marten studies, juveniles composed only a small fraction of martens captured and monitored (11%). This suggests low reproduction and/or juvenile survival during periods when juvenile martens were not monitored. This study is the first to estimate marten survival in Wisconsin and indicates that success of marten reintroductions in northern Wisconsin may not be limited by adult marten survival or juvenile survival during winter.

### 223 MOVEMENT OF A SOLITARY CARNIVORE IN A PATCHY LANDSCAPE

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Movement of carnivores through spatially heterogeneous landscapes is a topic of considerable interest to mammalogists. Midwestern landscapes are known to contain potential movement barriers to carnivores, such as roads and large expanses of agricultural land use generally devoid of stalking cover and prey. Despite analytical advancements in the study of animal movement, previous studies of bobcat (*Lynx rufus*) movements have involved relatively simple analyses of rates and distances traveled. We analyzed 93 movement paths of 17 (9 M, 8 F) adult bobcats (*Lynx rufus*) radiotracked in southern Illinois, USA, during 1998. Similar to most bobcat studies, males traveled further and faster than females, which is largely attributable to their polygynous mating system. We also quantified characteristics of movement paths such as step length, turning angle, residency time, velocity and fractal dimension. The average fractal dimension (D) for female movement paths was greater (D=1.60) than the average for male paths (D=1.41), indicating that females exhibited more localized movements and males moved in a more linear fashion. We used multiple regression analysis to
relate movement parameters to 12 landscape variables (e.g., forest patch density, percentage of grassland) quantified within buffered movement paths. Bobcat movement response to landscape structure differed between males and females. Our study provides insight into how a solitary carnivore moves through a spatially heterogeneous landscape and will allow for the creation of individually-based models of bobcat movement.

224 MULTISCALE HOME RANGE SELECTION AND HABITAT ASSOCIATIONS OF BADGERS IN AGRICULTURAL LANDSCAPES

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American badgers (*Taxidea taxus*) are solitary, semi-fossilorial mustelids typically associated with grassland and open prairie habitats. Given their role as carnivores and fossorial nature, they may be sensitive to landscape fragmentation. We used radiotelemetry data from Illinois (1990-1995) and Ohio (2005-2007) combined with observation records from Ohio to assess multiscale landscape use. Specifically, our objectives were to determine 1) if badgers selected specific habitats and patch structures within their home ranges, 2) if badgers selectively established home ranges with respect to habitat availability in study areas, and 3) the habitat associations of badgers in Ohio using observation data. Home ranges (100% minimum convex polygon) were estimated for 5 badgers in Ohio and 16 badgers in Illinois. At the home range scale badgers selected agricultural habitat over all other habitats, and decreasingly by wetland association, mixed woodland, and grassland habitats in both Ohio (W=3.25, P<0.05) and Illinois (W=1.97, P<0.05). The home range size for badgers in Ohio (3.91, +/- 2.31 km2) was much smaller compared to badgers in Illinois (33.00 +/- 24.39 km2). In Ohio badgers did not appear to selectively establish home ranges compared to the available habitat and patch structure in the study area. Badgers in Illinois appeared to select home ranges in the study area based upon small and interspersed of blocks of habitat, particularly agriculture. Finally, we recorded 134 observation records of badgers during 1990-2007, and compared these to random points for multiscale habitat modeling in Ohio. Observation data indicated that badgers were associated with agricultural habitats and a moderately low density interspersion of linear grasslands at both the home range and landscape scale. Our results suggest that badgers in a fragmented agricultural landscape are largely selecting interspersed patches of agricultural and grassland habitat.

226 CAPSTONE LECTURE 2008, YELLOWSTONE WOLVES: ECOLOGY, POPULATION REGULATION, AND AGE STRUCTURE

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Absent for nearly 70 years, wolves were reintroduced to Yellowstone National Park (YNP) in 1995 and 1996. Present at park establishment in 1872, wolves were systematically removed. Once reintroduced population growth was rapid and averaged 17%/year, except in 1999 and 2005 when the population declined due to disease, probably canine distemper, but also canine parvo-virus. The population peaked in 2003 at 174 wolves in 14 packs and then again in 2007 at 171 wolves in 11 packs. Fewer packs led to larger packs (2003 = 10 wolves/pack, 2007 = 14 wolves/pack) and pack size ranged from 2-37. Pup survival ranged from 30 - >90% and there was some indication that pup survival was density dependent, but pups born was not. Multiple litters/pack was recorded and is
thought to be a result of abundant food and some breeders being unrelated to subordinate pack members (relaxation of inbreeding avoidance). Population density was greatest in the northern region (NR) of the park, peaking at 98 wolves/1000 km$^2$, making it one of the densest areas for wolves in North America. The park interior had a much lower wolf population density at 10-20 wolves/1000km$^2$. A variety of mechanisms are hypothesized to regulate animal populations, though for most species, empirical data appropriate for evaluating competing hypotheses are lacking, especially for larger mammals like wolves. We evaluated support for two hypotheses about wolf population regulation: the biomass hypothesis (extrinsic regulation), which states that wolf density is determined by the available ungulate biomass, and the intrinsic regulation hypothesis, which states that wolf density has some upper limit imposed by social or territorial mechanisms (intrinsic regulation). Ungulate biomass available to wolves on the NR was several fold higher than reported for 32 studies across North America, and according to this hypothesis wolf numbers should have been much greater (98-150 wolves/1000 km$^2$), suggesting some limit to high density other than biomass. Modeling an alternative hypothesis to explain the relationship between wolf density and ungulate biomass indicated that a non-linear Michaelis-Menten model did much better at explaining the NR data, suggesting an upper limit to food regulated density. We therefore suggest that at high density, wolves may be regulated by social strife. The age structure of Yellowstone wolves has been gradually growing older through time. More wolves are living to older ages as evidenced by pack composition and a yearly increase in the average age at death (currently mean = 4 yrs). Retention of young in packs, high survival, and increasing age has created large packs that are comprised of wolves of many different ages. Most packs have at least one adult male and female (usually both) that are >5 years of age along with several other wolves in the 1 - 5 year age classes. The role of these older wolves is unknown but differing roles and functions of older wolves may be a possibility. For example, both males and female wolves do not achieve maximum body size until they are between 4 and 5 years of age, and males become significantly larger than females (about 20% larger). These size differences may cause males and females to have different functions in hunting elk and bison as well as in territory defense, in addition to the already recognized differences due to pup rearing (raising pups inside of dens).
Tanis, Brian P. 55
Tanner, Cheryl L. 34
Taylor, Peter J. 82
Thompson, Cody W. 71, 144
Thompson, Daniel J. 109, 219
Thorington, Katherine K. 1
Thorington Jr., Richard W. 35
Three Irons, Valerian 93
Timm, Robert M. 187
Trela, Stephanie 46
Tsai, Chia-Chun 65, 87, 135
Turmelle, Amy S. 185a
Turner, Gregory 216
Unangst Jr., Edward T. 147, 148
Vallera, Amaber M. 210
Van Deelen, Tim 143
Van Den Bussche, Ronald A. 13, 36, 201, 204
Van Stam, Elisabeth 83
Vanderlaan, Angelia S. M. 200b
VanKuren, Andrew 216
Velazco, Paulo M. 4
Ver Steeg, Barbara 224
Vodzak, Megan E. 142
von Oettingen, Susi 116
Vonlinden, Ryan 116
Waldvogel, Jerry A. 95
Walter, W. David 181
Wang, Chia-Chi 135
Wang, Ying 135
Warner, Richard E. 224
Warren, Daniel 46
Waser, Peter M. 15, 39
Wasilko, Scott M. 142
Weaver, Scott C. 26
Weigl, Peter D. 6
Welch, Corey K. 144
West, Stephen D. 58
Whatton, James F. 35
Whitaker Jr., John O. 160
White, Jeremy A. 41
White, Timonthy S. 65
Whiting, Jericho C. 193
Whittaker, Joseph C. 52, 54, 59
Widmaier, Eric P. 112
Wilkins, K. T. 111
Williams, Bronwyn W. 65
Williams, James 54
Willig, Michael R. 26, 27, 131
Willingham, Alison 162
Wilson, Ryan R. 99
Winterrowd, Michael 174
Wisely, Samantha M. 90, 212
Witham, James H. 197
Woodford, Jim 65
Woodma, Neal 31
Woods, Brett C. 94
Wooten, Michael C. 104
Worrell, Michael B. 134
Wright, Jeffrey D. 164
Wright, John L. 129
Wydeven, Adrian 143
Yang, Dou-Shuan 144
Young, Sarah 70
Yuan, Amy 126
Yunger, John 210
Zervanos, Stam M. 95
Zhijie, Jack Tseng 98
Zimmerman, Teresa J. 211b
Zollner, Patrick A. 60, 65, 87, 129, 222
Zugmeyer, Claire A. 144
Zuk, Marlene 153
Zwolak, Rafal 110
SDSU: 2008 ASM Meeting Venues

Performing Arts Center
- Plenary/Award talks
- Members Meeting
- Symposia/Capstone speaker
- Socials/Vendor displays
- Poster sessions in Foyer

Rotunda Complex
- Technical Sessions
- Breaks / Refreshments
- Committee meetings

Student Union
- Meal plan / Coffee

Caldwell Dorm
- Committee meetings
Bar/Restaurant Map

1. Skinners Pub (ATM) // Pizza King
2. Cubbys’ Sports bar // George’s Pizza
3. O’Hare’s bar & Ram restaurant
4. Subway sandwiches // Nick’s Bugers
5. Safari lounge // Cottonwood Coffee
6. Pizza Hut
7. Taco John’s
8. Bravos restaurant
9. McDonalds
10. Arby’s
11. Guadalahara restaurant
12. Perkins restaurant // Walmart
13. KFC // Z’kota restaurants
14. Comfort Inn Motel
15. Days Inn // Pavilion bar & grill
16. Stauroline Inn // Restaurant & bar

*Located across I-29
- Applebee’s
- Holiday Inn Express
- Fairfield Inn & Suites
- Super 8 Motel