UAF Summer Trails

**GORDAN L. KIRKLAND MEMORIAL RUN/WALK**
Route for the 11th Annual Fun Run (5km or 2km)

**MULTIPURPOSE TRAILS**
Any muscle-powered use. No motorized use.

**CALYPSO ORCHID TRAIL AND NATURE WALK**
Walking, running and leashed dogs. Horses and bikes prohibited. No motorized use.

**WET TRAILS**
Difficult areas for walking or biking. Trails may be closed or restricted during spring runoff and other extreme wet periods. No motorized use.

**TRAIL-USER PARKING**
No decal required for short-term trail use. (The west campus parking lots are open to the public evenings and weekends.)

**K** Lettered locator signs are placed at major trail junctions.

This map shows many existing recreation trails and access roads. UAF's multi-use north campus area is home to many research projects and is a valuable area for education. Please respect and do not disturb the numerous scientific research projects, plots, markers and equipment out in the north campus lands. For more information about the north campus area and the trail system visit www.uaf.edu/mastplan/northcampus/.

Help UAF maintain and improve the trails! Join the University Trails Club! Visit www.uaf.edu/trails/

Updated 10/2008
**General Conference Information**

**Registration Desk**
The conference Registration Desk will be located in the Great Hall of the Fine Arts Building.

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>Wednesday, June 24</td>
<td>1100–1800</td>
</tr>
<tr>
<td>Thursday, June 25</td>
<td>0800–1800</td>
</tr>
<tr>
<td>Friday, June 26</td>
<td>1000-1015, 1330-1500</td>
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<tr>
<td>Saturday, June 27</td>
<td>1000-1030, 1200-1330</td>
</tr>
<tr>
<td>Sunday, July 28</td>
<td>1200-1330</td>
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</tbody>
</table>

**11th Annual Gordon L. Kirkland Memorial Run/Walk for Research**
Saturday 27th June 2009

**Race Starts** 6:30 a.m. (yes, that is a.m.) at the UAF West Ridge Ski Hut (indicated on the Summer Trails map)

**Entry fee:**
- $15 (no t-shirt)
- $25 (includes t-shirt designed by local cartoonist Jamie Smith)

*All proceeds go to the American Society of Mammalogists (ASM) - Future Mammalogists Fund, which provides research grants to undergraduates and graduates in the field of mammalogy.*

**Length:** 5k or 2k run/walk

**Race Course:** Our local, scenic running trails located on campus (see Summer Trails map).

**Race Contact:** Kyndall Hildebrandt, fskbh1@uaf.edu

**Sign up:** Pre-race registration during Registration Desk Hours (above) in the Great Hall

**Parking**
After 1700 on weekdays and all day on weekends, parking is free in all lots on campus (except Handicapped and Reserved spaces). **On weekdays during the day,** there are two options. To park anywhere on campus, please use the parking kiosks located in the Taku Parking Lot and the Nenana Parking Lot and other sites around campus to purchase a pass (~$3 a day).

Or, you can park in the Taku Lot 8C or Nenana Lot 4F for free. Free shuttles run from 0730 to 1930 from these lots throughout campus. Two-hour metered visitor parking spaces are located in the Signers’ Hall and Bunnell lots.

**Shuttle Bus Service**

**Airport shuttle to and from campus:**
This service is provided for those staying in campus housing. A shuttle will be provided from the airport to hotels/campus on Wednesday June 24th. In addition rides from campus to the airport will be provided to the airport on Sunday June 28th (after 9pm) through Monday June 29th.

The airport is about 15 minutes from UAF. Taxi fare is approximately $15-20 to the UAF dorms from the airport. Rental car companies are located at the airport. Most hotels offer shuttle service to/from the airport. Contact your hotel for more information.

**Shuttle to evening events from campus:**
All buses leave from Wood Center, upper-level bus stop. Buses will be available (see below) for the Picnic on June 26th and the banquet on June 27th.

**Bus Schedule**

<table>
<thead>
<tr>
<th>June 26th</th>
<th>June 27th</th>
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</thead>
<tbody>
<tr>
<td>To Picnic:</td>
<td>To Banquet:</td>
</tr>
<tr>
<td>17:15-18:15</td>
<td>17:15-18:15</td>
</tr>
<tr>
<td>To Campus:</td>
<td>To Campus:</td>
</tr>
<tr>
<td>20:30-21:30</td>
<td>23:00-24:00</td>
</tr>
</tbody>
</table>
Telephone Numbers
UAF information 474-7211 or 474-7034
Campus Police 474-7721
UAF Conference Housing 474-6769

Emergency: Dial 911: All campus phones and pay phones have 911 access. Special emergency phones are marked with blue lights and are available for use throughout the UAF campus.

T-shirts
Conference t-shirts will be available for purchase ($15) while supplies lasts.

Recreational Facilities
The Student Recreation Center (SRC) is available to all registrants and their guests at a rate of $8 per day, payable at the entrance. Facilities include a running track, free weights and weight machines, and basketball and tennis courts. You will need to carry in an extra pair of sneakers to use the SRC facilities (474-5886). There is an ice skating rink adjacent to the SRC.

UAF Bookstore And Post Office
The UAF Bookstore upstairs in Constitution Hall carries a wide selection of books, UAF clothing and insignia, personal care items, and an assortment of food, drinks and over-the-counter medications. Hours are 0800–1700 weekdays. The UAF Post Office is located in the lower level of Constitution Hall and is open 1000–1600 weekdays.

Smoking Policy
No smoking is allowed inside buildings at the University of Alaska Fairbanks, including residence halls, dining halls, and the student center.

SAFETY and SECURITY
UAF is a safe and comfortable environment, but be prudent. Walk in the company of at least one other person, especially when off-campus. Call the Campus Police if you become aware of a situation that concerns you from a security or safety standpoint.

DO NOT LEAVE VALUABLES IN YOUR ROOM. NEITHER THE ORGANIZERS, NOR THE UNIVERSITY OF ALASKA FAIRBANKS, ARE RESPONSIBLE FOR LOST OR STOLEN ITEMS.

Please be aware that in order to consume alcoholic beverages at any event at which alcohol is served, you must be 21 years of age or older and be prepared to show identification.

Fairbanks Environment
Day length: There are about 20 hours of possible sunlight in mid-June (sun up at 0400 and down at midnight) and, if it is not cloudy, there will be daylight all night. You may find sleeping more comfortable if you have eyeshades. Remember – just because it is not dark out doesn't mean that it is not time to get some sleep. In addition, while the sunlight is not as intense as lower latitudes, continual exposure in our long days can quickly bring on sunburn. Remember to pack lotion or clothing to cover up!

Mosquitoes: Mosquitoes will probably be in good supply, though not bad on campus. Elsewhere in Fairbanks, you may want to carry mosquito repellent with you. Wearing long-sleeved shirts and long pants is recommended.

Aridity: Fairbanks, Alaska, is very dry. Make sure you drink plenty of water.

Temperature: Be prepared for a range of temperatures at this time of year. You can expect a range of about 45–75° F, (7-24 °C) but the record high was 91°F (33 °C) and record low was 30° F (-1 °C).
HEALTH and MEDICAL NEEDS
There are two walk-in medical facilities in Fairbanks:

Fairbanks Urgent Care Center  452-2178  weekdays  0700–2100
1867 Airport Way, Suite 130B  weekends  1000–1900

Tanana Valley Clinic 1st Care  458-2682  daily  0800–2000
1001 Noble Street

ATM Machines on campus
Wood Center (available during Wood Center hours)
Hess Commons, near the Housing Office (available 24 hours)

Banking
Spirit of Alaska Federal Credit Union located in the Wood Center: Hours 1100–1600 weekdays. For full service banking needs, there is a Wells Fargo Bank on the corner of University Avenue and Geist Road.

Local Food Shopping
There are two grocery stores, Fred Meyers and Safeway, located on the corner of University Avenue and Airport Way.

Information for Presenters
Oral Presentations: Oral presentations must be created in PowerPoint format; each PowerPoint presentation file must adhere to the guidelines provided on the conference website. Oral presentations will be allotted 12 min for the talk and 3 min for questions. Pre-submission of PowerPoint presentations will not be required. Presenters must bring their presentations to the assigned session at least 15 minute prior to the start of that session on either a USB flash drive or CD. The computers used for presentations will NOT have internet access. PowerPoint files created on Macintosh computers should be previewed on a PC to ensure cross-platform compatibility. Computer stations (with PCs only) will be available in the Great Hall and the Wood Center for previewing. Laser pointers will be available.

Poster Presentations: Posters assigned to the first session (Friday 3:30-5:30 p.m.) can be set up as early as Thursday afternoon, must be in place no later than one hour before the start of the session, and must be removed by noon on Saturday. Posters assigned to the second session (Sunday 8:30-10:30 a.m.) can be set up any time after noon on Saturday, must be in place before the start of the session, and must be removed by 5:00 p.m. on Sunday. Each space will be clearly numbered with the abstract number assigned to that poster. Presenters are responsible for providing their own mounting materials (thumbtacks or T-pins only; adhesives will not be allowed). Each presenter should be present for at least one hour during their assigned session to answer questions.

Name tag color scheme
Red: Local Committee member
Green: Director, officer, other high-ranking Society members
Black: Past president
Blue: Everyone else
RESPONSIBILITIES OF SESSION CHAIRS AT ANNUAL MEETINGS

Gail R. Michener, University of Lethbridge, Alberta, Canada

As Chair of a session, you are responsible for ensuring that speakers receive their allotted time, that speakers have optimal conditions for presenting their papers, and that the audience can hear and see the presentation. Time-keeping and identifying the next speaker and topic are the obvious and minimal responsibilities of a Chair. Additionally and importantly, a good Chairperson will be familiar with the room and equipment, will know what potential problems may arise, will run the question period, will be responsible for audience management, and will keep the session on time. Because the session chair is ultimately responsible for all aspects of the session both from the perspective of the speaker and the audience, you need to be in command, without being intrusive.

The following suggestions will help you to be an effective session Chair.

1. **Attend papers in the room in which you will be chairing before your session** so that you can identify potential problems in advance. For example, note whether use of a microphone is necessary, whether room lighting can be adjusted appropriately, whether electronic pointers are visible on the screen, whether the podium light is positioned to avoid bleaching the screen, whether the clock is accurate. If you detect any problems, assume responsibility and immediately contact the Local Host to request improvements. *If you are chairing the first session to be held in a particular room, test everything yourself.*

2. **Arrive 10 minutes before your session** to check that all equipment and room facilities are present and functioning.

3. **Locate and identify each speaker in the session in advance.** If the speakers do not come to you, make an announcement about 5 minutes before the session begins and ask speakers to identify themselves to you. Show speakers how equipment works and indicate how you will identify time elapsed.

4. **Check the correct pronunciation of each speaker's name and study animal.** For multiply authored papers, determine which author is presenting. Mispronunciation of names and inability to identify the next speaker should never occur.

5. **Tell speakers how time intervals will be indicated.** The 11-minute mark should be signaled to allow speakers 1-2 minutes to conclude, leaving a further 2-3 minutes for questions. Ensure that your method of indicating time will be conspicuous even when the speaker is in full swing and not looking in your direction.

6. **Introduce the presentation quickly and efficiently.** Rather than simply reading the title and authors from the program (which any audience member can do for themselves), prepare a shortened title that will permit a speedy introduction of the next speaker.

7. **Use full room lighting for the introduction and question period.** Never dim room lighting before the speaker has made his/her introductory remarks. Once the speaker
refers to slides or requests reduced light, adjust lighting only enough to ensure that slides are visible; normally this means dimming only those lights that might interfere with visibility of the screen. Return the room to full lighting for the question period.

8. **NEVER plunge the audience into darkness.** The speaker needs to see the audience to gauge how effectively points are being made, and audience members need to see the speaker and have sufficient light to take notes. With most PowerPoint presentations, lighting in the audience portion of the room does NOT need to be dimmed.

9. **Keep the session on time.** To ensure that the speaker is aware of the time, use a large flash card or a buzzer to indicate relevant times, move into the line of view of the speaker, and wait until the speaker indicates that he or she has seen/heard your time signal.

10. **Be bold. Interrupt if necessary.** For concurrent sessions to stay in synchrony, speakers MUST leave the podium at the 15-minute mark. To be fair to all speakers, it is the session chair’s responsibility and obligation to move on to the next speaker at the allotted time.

11. **Run the question period** by standing up and positioning yourself to be able to see any raised hands; do not sit down during the question period. Select the next person to ask a question, and indicate when question time is about to run out. The chair, not the speaker, controls the question period; make sure the speaker knows this.

12. **Allow the audience to see the speaker.** Ensure room lights are turned fully on during question period and during introduction of the next speaker. Do not adjust room lights until the next speaker requests this. Good speakers will initially speak to the audience with full lighting on so that audience members can see who they are.

13. **Manage the audience.** Allow a brief period between speakers for audience members to move in and out of the room, thereby avoiding noise and shuffling as the next speaker begins. Adjust this interval according to the amount of audience turn-over; usually <30 seconds is adequate. Indicate if empty seats are available at the front or within rows and allow people time to move to these seats. Request people move away from doorways and sit down.

14. **Read abstracts and have a question ready to ask the speaker** in the event of an awkward silence when no questions are forthcoming from the audience. Every speaker deserves to have at least one question asked if time permits, so read the abstracts for your session in advance.

15. **Announce cancellations** in your session at the beginning of the session. Additionally, note cancelled papers on the white/black board and post a notice on both sides of any doors to the room.

16. **Do not make unannounced changes to the program.** Talks must be presented in their designated time slots so that people can plan which papers to attend and when. If a paper is cancelled mid-session, wait until the next designated time so that remaining presentations are given at their scheduled times.

17. **Inform the Local Host of problems or issues.** If a speaker fails to appear at the allotted time or if any unusual problems arise, especially any requiring attention to improve subsequent sessions in that room, immediately inform the Local Host.
<table>
<thead>
<tr>
<th>Technical Session #</th>
<th>Technical Session Title</th>
<th>Time Slot</th>
<th>Session Chair</th>
<th>Location</th>
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<tbody>
<tr>
<td>1</td>
<td>Biogeography 1</td>
<td>Thursday 2-3:30</td>
<td>Jake Esselstyn</td>
<td>Davis Concert Hall</td>
</tr>
<tr>
<td>2</td>
<td>Behavior 1</td>
<td>Thursday 2-3:30</td>
<td>Jon Jenks</td>
<td>Schaible Auditorium</td>
</tr>
<tr>
<td>3</td>
<td>Ecology 1</td>
<td>Thursday 2-3:30</td>
<td>Bob Dowler</td>
<td>Wood Center Ballroom</td>
</tr>
<tr>
<td>4</td>
<td>Kenagy</td>
<td>Thursday 4-5:30</td>
<td>Brian Barnes</td>
<td>Davis Concert Hall</td>
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<tr>
<td>5</td>
<td>Conservation 1: Bats &amp; Seals</td>
<td>Thursday 4-5:30</td>
<td>DeeAnn Reeder</td>
<td>Schaible Auditorium</td>
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<tr>
<td>6</td>
<td>Landscape Genetics</td>
<td>Thursday 4-5:30</td>
<td>Marjorie Matocq</td>
<td>Wood Center Ballroom</td>
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<tr>
<td>7</td>
<td>Conservation 2</td>
<td>Friday 8-9:45</td>
<td>Ed Heske</td>
<td>Davis Concert Hall</td>
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<tr>
<td>8</td>
<td>Nutrition</td>
<td>Friday 8-9:45</td>
<td>Perry Barboza</td>
<td>Schaible Auditorium</td>
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<tr>
<td>9</td>
<td>Morphology</td>
<td>Friday 8-9:45</td>
<td>Neal Woodman</td>
<td>Wood Center Ballroom</td>
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<tr>
<td>10</td>
<td>EPSCoR- Small Nonvolant Mammals</td>
<td>Friday 1:30-3:30</td>
<td>Hayley Lanier</td>
<td>Davis Concert Hall</td>
</tr>
<tr>
<td>11</td>
<td>Parasites</td>
<td>Friday 1:30-3:30</td>
<td>Paul Stapp</td>
<td>Schaible Auditorium</td>
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<tr>
<td>12</td>
<td>Behavior 1-Large Mammals</td>
<td>Friday 1:30-3:30</td>
<td>Roger Powell</td>
<td>Wood Center Ballroom</td>
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<tr>
<td>13</td>
<td>Biogeography 2</td>
<td>Saturday 8:30-10</td>
<td>Felisa Smith</td>
<td>Davis Concert Hall</td>
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<tr>
<td>14</td>
<td>Genetics</td>
<td>Saturday 8:30-10</td>
<td>Sacha Vignieri</td>
<td>Schaible Auditorium</td>
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<tr>
<td>15</td>
<td>Behavior 2-Small Mammals</td>
<td>Saturday 8:30-10</td>
<td>Karen Munroe</td>
<td>Wood Center Ballroom</td>
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<tr>
<td>16</td>
<td>Phylogeography</td>
<td>Saturday 1:30-3:00</td>
<td>Natalie Dawson</td>
<td>Davis Concert Hall</td>
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<tr>
<td>17</td>
<td>Ecology 2</td>
<td>Saturday 1:30-3:00</td>
<td>Winston Smith</td>
<td>Schaible Auditorium</td>
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<tr>
<td>18</td>
<td>Physiology 1</td>
<td>Saturday 1:30-3:00</td>
<td>Ian van Tets</td>
<td>Wood Center Ballroom</td>
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<td>19</td>
<td>Biogeography/Phylogeography/Systematics</td>
<td>Saturday 3:30-5</td>
<td>Brandi Coyner</td>
<td>Davis Concert Hall</td>
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<td>20</td>
<td>Physiology 2</td>
<td>Saturday 3:30-5</td>
<td>Eileen Lacey</td>
<td>Schaible Auditorium</td>
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<td>21</td>
<td>Conservation 3</td>
<td>Saturday 3:30-5</td>
<td>Andrew Van Eck</td>
<td>Wood Center Ballroom</td>
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<td>22</td>
<td>Systematics</td>
<td>Sunday 10:30-12</td>
<td>Kristofer Helgen</td>
<td>Davis Concert Hall</td>
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<tr>
<td>23</td>
<td>Behavior 3</td>
<td>Sunday 10:30-12</td>
<td>Bill Lidicker</td>
<td>Schaible Auditorium</td>
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<tr>
<td>24</td>
<td>Conservation 4</td>
<td>Sunday 10:30-12</td>
<td>Steve Sheffield</td>
<td>Wood Center Ballroom</td>
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<tr>
<td>25</td>
<td>EPSCoR- Large or Volant Mammals</td>
<td>Sunday 1:30-3:15</td>
<td>Link Olson</td>
<td>Davis Concert Hall</td>
</tr>
<tr>
<td>26</td>
<td>Population ecology</td>
<td>Sunday 1:30-3:15</td>
<td>George Feldhamer</td>
<td>Wood Center Ballroom</td>
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</tbody>
</table>
UAF INFORMATION TECHNOLOGY ESSENTIALS

All users of University computing hardware, software, networking services, or any property related or ancillary to the use of these facilities must abide by this agreement.

Acceptable Network Usage Agreement
The University expects that all persons who make use of University computing hardware, software, networking services, or any property related or ancillary to the use of these facilities will abide by the following policy statement:

University information technology resources are provided to the university community and are to be used in the spirit of mutual cooperation. Resources are limited and must be shared. Everyone benefits when computer users avoid activities which may cause problems for others sharing the systems.

Hardware, software, and related services supplied by the University are intended for the purpose of implementing and supporting the university's mission, as set forth in Board of Regents Policies and Regulations. Misuse of these facilities is a violation of those Policies and Regulations, and may additionally be illegal. It is a violation to provide or obtain passwords to accounts other than one's own.

By making use of UAF facilities you agree to the following conditions:

You will not use university hardware, software or services without proper authorization. You agree to use licensed software on university machines; copying, distributing and/or using software without proper licensing is a violation of federal copyright law. You may not extend use of university computing facilities for any purpose beyond their intended use, nor beyond those activities sanctioned in Regents' Policy and Regulations.

University computing facilities may not be used:

• for personal profit or gain
• to harass, threaten, or invade the privacy of others
• to initiate or forward e-mail chain letters
• to cause breaches of computer, network or telecommunications security systems
• to initiate activities which unduly consume computing or network resources

Individuals who violate this policy will be subject to disciplinary action and/or referral to law enforcement authorities. Division of Computing and Communications personnel are authorized to monitor suspected violations and to examine items stored on any university storage medium.

Computer system availability:

There will be computers available in the Great Hall during the conference to check e-mail. There will also be PC workstations set up in the Great Hall and the Wood Center for previewing your powerpoint presentations.

Wireless Network Access:

You will have access to the UAFnet wireless (via GuestNet) network in the Great Hall, Wood Center, Library, Schaible Auditorium, and in the lobby of the upper campus dorms.
Local Restaurants

Local area dining – Fairbanks and the outlying area within walking distance of UAF
•Bun on the Run – Sandwiches and desserts (Trailer in the parking lot of Beaver Sports, 2480 College Road)
•College Coffee House – Espresso, light meals (3677 College Road) 374-0468
•College Town Pizzeria – Pizza and gelato (3549 College Road) 457-2200
•Gulliver's Books & Second Story Café – Sandwiches, soups (3525 College Road) 474-9574
•Hot Licks – Homemade ice cream (3453 College Road) 479-7813
•Pad Thai – Thai (3400 College Road) 479-1251
•Pita Pit – Falafel and light Greek food (~3282 College Road) Weds-Sat
•Sipping Streams – Tea house, light meals(3535 College Road) 457-1660

Bars
•The Red Fox – (398 Old Chena Pump Road) 479-9082
•The Marlin – (3412 College Road) 479-4646
•The Pub – On campus, Wood Center 474-7805
•The Oasis – (734 University Ave.) 458-8020

Marginal walking distance from UAF
•Alaska Coffee Roasting Company – Espresso, light meals (4001 Geist Road)
•Lemon Grass – Thai (388 Old Chena Pump Road) 456-2200
•Lulu’s Bakery – (475 Riverstone Way) 374-3804
•Pizza Hut (4001 Geist Road)
•Wolf Run – Light meals and desserts (3360 Wolf Run, off University Avenue) 458-0636

Need a car – casual dining
•Alaska Salmon Bake – Salmon, halibut, prime rib (Pioneer Park) 452-7274
•The Bakery Restaurant – Family style (69 College Road) 456-8600
•Boston's Pizza – Family style (Old Steese Highway) 458-9222
•Brewsters – Burgers, salads (3578 Airport Way) 456-2538
•Brueggers – Bagels, soups, salads, sandwiches (36 College Road) 452-3940
•The Chowder House – Chowder, soup, sandwiches (206 Eagle Avenue) 452-2882
•Cookie Jar – Family style (1006 Cadillac Court) 479-8319
•Denny's – Family style (1929 Airport Way) 451-8950
•El Sombrero – Mexican (1420 Cushman Street) 456-5269
•Food Factory – Burgers, hot wings, cheese steak (44 College Road) 452-3313
•Geraldo's – Italian (3226 Airport Way) 474-0409 (701 College Road) 452-2299
•Hot Tamale – Mexican (112 North Turner) 457-8350
•Ivory Jack's – 2nd best burger in Alaska, pizza (2581 Goldstream Road) 455-6665
•Sweet Basil Thai Restaurant – Thai (1448 South Cushman Street) 456-2170
•Taco Azteca – Mexican (3401 Airport Way) 455-8226
•Thai House Restaurant – Thai (526 5th Avenue) 452-6123
•Silver Gulch – Brewery (1295 Old Steese Highway) 452-2739

Need a car – fine dining
•Bear 'n' Seal Grill & Bar (813 Noble Street, in the Westmark Hotel) 459-7725
•Gambardella's Pasta Bella – Italian (706 2nd Avenue) 457-4992
•Lavelle's Bistro (575 1st Avenue, in the Spring Hill Suites Marriott Hotel) 450-0555
•Pike's Landing Fine Dining & Sports Lounge – Fish, steak, seafood (4438 Airport Way) 479-6500
•Pump House Restaurant & Saloon – Fish, steak, seafood (Mile 1.3 Chena Pump Road) 479-8452
•Turtle Club -Prime rib and crab (Mile 10 Old Steese Highway) 457-3883
•Two Rivers Lodge Fine Dining – Everything from alligator to steak (Mile 16 Chena Hot Springs Road) 488-6815
•The Vallata – Italian (2190 Goldstream Road) 455-6600
•Zach's – Steak, seafood, pasta (1717 University Avenue) 479-3650
Things to do in Fairbanks and the surrounding area

Activities on campus
• Check out the local events: http://newsminer.com/news/latitude65/
• Georgeson Botanical Garden – Numerous varieties of flowers and vegetables cultivated for Alaska's climate. Open for viewing daily. 474-1944
• Robert G. White Large Animal Research Station – View muskox, caribou, and reindeer. Tours daily. 474-7207
• University of Alaska Museum of the North – Discover fascinating stories about Alaska’s people, places, and wildlife. Audio guide available. Museum store. 0900–1900. 474-7505

Activities around town
• Alaskan Tails of the Trail with Mary Shields – Learn about Mary's adventures in mushing the Iditarod and through the Alaska wilderness. http://www.maryshields.com/
• Chena Bend Golf Course – Beautiful golf course located on Fort Wainwright. 353-6223
• Chena Hot Springs Resort – Soak in the hot springs and visit the ice museum. 1-800-478-4681
• Creamer's Field Migratory Waterfowl Refuge. 452-5162
• El Dorado Goldmine – Ride the Tanana Valley Railroad and pan for gold. 479-6673
• Fairbanks Golf and Country Club – Play a game of golf under the midnight sun. 479-6555
• Gold Dredge No. 8 – Visit a gold dredge and pan for gold. 457-6058
• Greatland River Tours (Tanana Chief) dinner & Sunday brunch cruises. 452-8687
• Ice Museum – Ice sculptures on display. Downtown on 2nd Avenue. 451-8222
• Midnight Sun Balloon Tours – Take a breathtaking trip over the Tanana Valley. 456-3028
• North Star Golf Club – Northern-most USGA golf course. 457-4653
• Pioneer Park – Visit this historic park for Fairbanks history, train rides, miniature golf, picnic grounds, and many gift shops housed in historic log cabins. 459-1087
• Palace Theatre and Saloon – Musical comedy about early Fairbanks. 458-5960
• Riverboat Discovery – Enjoy a boat cruise on the Chena and Tanana Rivers, including a guided walking tour of an Indian Village. 479-6673
• Tanana Valley Farmers Market – View what Fairbanks area farmers and artisans have produced. 2600 College Road, Wednesdays & Saturdays.
• Trans-Alaska Pipeline – Information and viewing, on the Steese Highway.

Art galleries and shops
• Fairbanks Arts Association – Bear Gallery in the Pioneer Park Civic Center. 456-6485
• Artworks – 3677 College Road. 479-2563
• New Horizons Gallery – 519 1st Avenue. 456-2063
• Alaska House – 1003 Cushman Street. 456-6449
• Well Street Art Company – 1304 Well Street. 452-6169
• Knotty Shop – Wood crafts, burl carving and 30-foot totem pole. 488-3014
• Santa Claus House – North Pole. 488-2200

Be adventurous
• Rent a canoe and travel on the Chena River.
• Hike one of the many trails located throughout the Tanana Valley.
• Visit Denali National Park.
• Relax at one of the numerous lakes for a camping and fishing trip.
• Alaska Public Lands Information Center – 250 Cushman St. Suite 1A. 456-0527.

Shopping near campus
• Beaver Sports – Sporting goods, clothing (3480 College Road) 479-2494
• Date Line Copies – Copying, office supplies (3677 College Road) 479-3831
• Fred Meyer – Groceries, housewares, clothing (3755 Airport Way)
• Gulliver's Books – Books, gifts (3525 College Road) 474-9574
• Safeway – Groceries (3627 Airport Way)
ACKNOWLEDGEMENTS

Organizing Committee Chairs: Link Olson, Kris Hundertmark, Brandy Jacobsen, Hayley Lanier

Local Committee:
Perry Barboza (LARS guide)
Brian Barnes (special session coordinator)
Lindsay Blaine (LARS tour coordination)
Ryan Cooper (program compilation)
Kevin Colson (vendor coordination)
Patrick Druckenmiller (Permafrost Tunnel guide)
Kerynn Fisher (public relations, UAM)
Marie Gilbert (public relations, IAB)
Adam Gillette (special capstone technician)
Aren Gunderson (poster and catering coordination)
Mareca Guthrie (graphic design)
Karen Hibbard-Rode (signage)
Kyndall Hildebrandt (Run for Research)
Kris Hundertmark (IAB liaison, LARS tour coordination, logistics)
Gretchen Hundertmark (abstract cleanup)
Brandy Jacobsen (UAM accreditation, auction and banquet coordination, budgeting)
Hayley Lanier (field trip coordination, website design, logistics)
Dusty McDonald (general assistance)
Link Olson (UAM liaison, program scheduling, logistics)
Dorothy Parkerson (venue reservations and coordination)
Maria Russel (event accounting and venue coordination)
Theresa Woldstad (committee meetings)
Ed Debevec & Jock Irons (website design, technical support, program compilation)
Jim Lawlor & Tom Meier (Denali field trip; National Park Service)

EPSCoR Landscapes Genetics Student Registration Waiver Committee: Link Olson, Kris Hundertmark, Hayley Lanier, and Trina Roberts
Special thanks to:
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Bob Hildebrandt and Patsy Perkins (Run for Research; The Toy Quest)
Linda Bahr, Heather Dukes (UAF Dining Services)
Heather Barile (Pub)
Gig Berglin (auction donations; Arctic Fire and Safety)
Amber Cagwin (UAF Residence Life)
Gulliver's Books
Mareca Guthrie (ASM 2009 logo; UAM)
Jennifer Jolis, Jamal Brown, Chris Harper, Ginessa Peter, Karen Lane, Golden Heart Greeters (General event facilitation; Fairbanks Convention and Visitors Bureau)
Erich Follmann (poster session refreshments; Arctic Institute of North America)
Catherine Grieve (Wood Center Events Services Coordinator)
Barb Hameister (posterboards; UAF Center for Global Change)
Ken Larimore (wardrobe; UAF Dept. of Athletics)
Elizabeth Lilly (technical assistance)
Lu Lu's Bread & Bagel (Run for Research)
Cheri Renson (UAF Events Coordinator)
Running Club North (Run for Research)
Buck Sharpston (UAF Center for Research Services)
Jamie Smith (Run for Research t-shirt and sleeping mask logos; Ester Republic)
<table>
<thead>
<tr>
<th>Day</th>
<th>Events</th>
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<tbody>
<tr>
<td>Tuesday, 23 June</td>
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<tr>
<td>1800-2100</td>
<td>Board of Directors Dinner, Pike's Landing Restaurant (transportation will be provided)</td>
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<tr>
<td>Wednesday, 24 June</td>
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<tr>
<td>0800-1700</td>
<td>Board of Directors Meeting, Wood Center E &amp; F</td>
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<tr>
<td>1000-1400</td>
<td>Large Animal Research Station, Permafrost Tunnel, and Pipeline Viewpoint Field Trip (4 hours)</td>
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<tr>
<td>1100-2300</td>
<td>Registration/Check-in, Great Hall and Dormitories</td>
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<tr>
<td>1800-2300</td>
<td>Opening Social, Wood Center Patio (light appetizers, host bar)</td>
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<tr>
<td>Thursday, 25 June</td>
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<tr>
<td>0800-0830</td>
<td>Welcome, Davis Concert Hall</td>
</tr>
<tr>
<td>0830-0945</td>
<td>Plenary Session 1, Davis Concert Hall (Chair: Sue McClaren)</td>
</tr>
<tr>
<td>0830</td>
<td>1: Evolutionary forces favoring intragroup coalitions in the spotted hyena (<em>Crocuta crocuta</em>) (Anna M. Jackson Award) — Smith</td>
</tr>
<tr>
<td>0845</td>
<td>2: Diversification of silky pocket mice in the <em>Perognathus flavus</em> species-group: Implications for the biogeography of North American arid grasslands (Elmer C. Birney Award) — Neiswenter, Riddle</td>
</tr>
<tr>
<td>0900</td>
<td>3: Molecular and environmental characterization of a woodrat hybrid zone: Evidence for habitat segregation among genotypic classes (A. Brazier Howell Award) — Shurtleff, Matocq</td>
</tr>
<tr>
<td>0915</td>
<td>4: Delayed dispersal and resource abundance in solitary kangaroo rats: Implications for family formation in mammals (Shadle Fellow) — Edelman</td>
</tr>
<tr>
<td>0930</td>
<td>5: Temporal consistency and spatial heterogeneity in the tempo of speciation among SE Asian shrews (ASM Fellow) — Esselstyn</td>
</tr>
<tr>
<td>0945-1020</td>
<td>Refreshment Break, Great Hall</td>
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<tr>
<td>1020-1200</td>
<td>Plenary Session 2, Davis Concert Hall (Chair: Michael Mares)</td>
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<tr>
<td>1020</td>
<td>6: Merriam Award Address: Marsupial tales: Diversity, demography, and interactions among the carnivorous marsupials of Australia — Dickman</td>
</tr>
<tr>
<td>1110</td>
<td>7: Grinnell Award Address: Enhancing education about the science and natural history of mammals — Brigham</td>
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<tr>
<td>1200-1330</td>
<td>Lunch, Lola Tilly Commons or Wood Center</td>
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<tr>
<td>1330-1500</td>
<td>Technical Session 1 — Biogeography 1, Davis Concert Hall (Chair: Jake Esselstyn)</td>
</tr>
<tr>
<td>1330</td>
<td>8: Biogeographic relationships and diversification processes among montane populations of <em>Myosorex</em> in Tanzania — Stanley, Esselstyn</td>
</tr>
<tr>
<td>1345</td>
<td>9: &quot;Antique&quot; DNA illuminates broad-scale geographic patterns in the <em>Tupaia belangeri</em>/<em>Tupaia glis</em> species group — Roberts, Sargis, Olson</td>
</tr>
<tr>
<td>1400</td>
<td>10: Environmental and geometric drivers of small mammal diversity along an elevational gradient in the Great Basin — Rowe, Rickart, Heaney, Balete</td>
</tr>
<tr>
<td>1430</td>
<td>11: &quot;Antique&quot; DNA illuminates biogeographic relationships and diversification processes in the <em>Myosorex</em> genus — Stanley, Esselstyn</td>
</tr>
<tr>
<td>1445</td>
<td>12: &quot;Antique&quot; DNA illuminates biogeographic relationships and diversification processes in the <em>Myosorex</em> genus — Stanley, Esselstyn</td>
</tr>
<tr>
<td>1500</td>
<td>13: &quot;Antique&quot; DNA illuminates biogeographic relationships and diversification processes in the <em>Myosorex</em> genus — Stanley, Esselstyn</td>
</tr>
<tr>
<td>1515</td>
<td>14: Aggressive defensive behavior by free-ranging white-tailed deer — Jenks, Grovenburg, Klaver, Jacques, Swanson</td>
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<tr>
<td>1530</td>
<td>15: Effects of <em>avpr1a</em> on social and genetic mating patterns in semi-natural populations of prairie voles — Solomon, Harding, Keane</td>
</tr>
<tr>
<td>1545</td>
<td>16: Scent marking and individual discrimination in raccoons (<em>Procyon lotor</em>) — Kent, Tang-Martinez</td>
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<tr>
<td>1600</td>
<td>17: Scent marking and individual discrimination in raccoons (<em>Procyon lotor</em>) — Kent, Tang-Martinez</td>
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<tr>
<td>1630</td>
<td>18: Scent marking and individual discrimination in raccoons (<em>Procyon lotor</em>) — Kent, Tang-Martinez</td>
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<tr>
<td>1645</td>
<td>19: Scent marking and individual discrimination in raccoons (<em>Procyon lotor</em>) — Kent, Tang-Martinez</td>
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<tr>
<td>1715</td>
<td>21: Home range and den site selection in the American gog-nosed skunk, <em>Conepatus leuconotus</em> — Brashier, Dowler, Ferguson</td>
</tr>
<tr>
<td>1730</td>
<td>22: On raptors and rodents: Reconstructing small mammal community dynamics from their skeletal remains — Terry</td>
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<tr>
<td>Time</td>
<td>Session 1: Small mammals of the Central Cordillera, Luzon</td>
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<tr>
<td>1415</td>
<td>Discovery, diversity, and survival — Heaney, Balete, Rickart, Veluz, Alviola</td>
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<tr>
<td>1430</td>
<td>Fire drives transcontinental variation in tree birch defense against browsing by snowshoe hares — Swihart, Bryant, Clausen, Landhausser, Carriere, Veitch, Popko</td>
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<tr>
<td>1445</td>
<td>Globetrotting: Patterns of similarity in mammalian distributions across continents — Harding, Smith, Lyons, Youberg, Brown</td>
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<tr>
<td></td>
<td>12: Fire drives transcontinental variation in tree birch defense against browsing by snowshoe hares — Swihart, Bryant, Clausen, Landhausser, Carriere, Veitch, Popko</td>
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<tr>
<td>1500-1530</td>
<td>Refreshment Break, Great Hall</td>
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<tr>
<td>1530</td>
<td>Technical Session 4 — Contributions of Jim Kenagy to Mammalogy, Davis Concert Hall (Chair: Brian Barnes)</td>
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<tr>
<td>1530</td>
<td>26: Introduction — Barnes</td>
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<tr>
<td>1545</td>
<td>27: Detecting natural selection in Pacific Northwest deer mice: An integrative approach — Yang, Kenagy</td>
</tr>
<tr>
<td>1615</td>
<td>29: Ecological and evolutionary forays with charismatic microvertebrates and El Jefe — Vignieri</td>
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<tr>
<td>1630</td>
<td>30: Comparative phylogeography of southern South America: Exploring patterns across taxa to understand regional evolutionary history — Himes</td>
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<tr>
<td>1645</td>
<td>31: Hibernation and the Ark — Geiser</td>
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<tr>
<td>1700</td>
<td>32: Hybridization in a pine squirrel (Tamiasciurus) contact zone in the Pacific Northwest — Chavez, Kenagy</td>
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### Friday, 26 June

<table>
<thead>
<tr>
<th>Time</th>
<th>Technical Session 7 — Conservation 2, Davis Concert Hall (Chair: Ed Heske)</th>
<th>Technical Session 8 — Nutrition, Schaible Auditorium (Chair: Perry Barboza)</th>
<th>Technical Session 9 — Morphology, Wood Center Ballroom (Chair: Neal Woodman)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830</td>
<td>55: Developing a habitat model for Franklin's ground squirrel using occupancy modeling — Duggan, Haske, Schooley.</td>
<td>61: Effect of maternal body condition and nutrient intake on milk intake of caribou and reindeer — White, Russell, Griffith, Cameron.</td>
<td>68: Comparison of wrist bones between ground, tree, and flying squirrels using MIMICS image processing software — Thorington, Miller.</td>
</tr>
<tr>
<td>0845</td>
<td>56: Urban landscape features influencing rodent control and animal movement in two urban areas of California — Morzillo, Riley, Cypher, Kamradt.</td>
<td>62: Dynamics of body reserves in captive muskoxen (Ovibos moschatus) during winter — Gustine, Barboza, Lawler.</td>
<td>69: Miocene to Pleistocene faunal turnover within Spermophilus of the Great Plains — Goodwin.</td>
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<tr>
<td>Time</td>
<td>Session 1</td>
<td>Session 2</td>
<td>Session 3</td>
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<tr>
<td>0915</td>
<td>Diet and food availability of the endemic Prince of Wales flying squirrel: Implications for dispersal — Flaherty, Ben-David, Smith</td>
<td>You are what you eat: The key role of mesquite in promoting survival in an extreme environment — Martin, Smith, Murray, Lease, Harding</td>
<td>Where art thou Ernanodon? Morphological and morphometric analyses of †Ernanodon to Xenarthra and other mammals — Shaw, Ruedas</td>
</tr>
<tr>
<td>0930</td>
<td></td>
<td>Foraging rates of wapiti on alfalfa/bromegrass pastures — Arthur, Hudson, Donkor, King</td>
<td>Growth, size, and sexual dimorphism in brown bears: Does size matter? — McDonough, Christ</td>
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<tr>
<td>0945-1015</td>
<td>Refreshment Break, Great Hall</td>
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<tr>
<td>1015-1200</td>
<td>Members Meeting I, Davis Concert Hall</td>
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<tr>
<td>1200-1330</td>
<td>Lunch, Lola Tilly Commons or Wood Center</td>
<td>Technical Session 10 — Alaska EPSCoR landscape genetics student session 1, Davis Concert Hall (Chair: Hayley Lanier)</td>
<td>Technical Session 11 — Parasites, Schaible Auditorium (Chair: Paul Stapp)</td>
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<tr>
<td>1330-1530</td>
<td>Technical Session 12 — Behavior 2, Wood Center Ballroom (Chair: Roger Powell)</td>
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<td>1330</td>
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<td>72: Phylogeography of a holarctic shrew: The tundra shrew (Sorex tundrensis) — Hope, Cook</td>
<td>79: PCR identification of mammalian hosts of fleas — Franklin, Stapp, Cohen</td>
</tr>
<tr>
<td>1345</td>
<td>73: Linking genetic structure to landscape structure: Glaucosmys sabrinus coloratus in the southern Appalachians — Wartell</td>
<td>80: Evidence that urbanization alters host-parasite dynamics in coyote populations — Willingham, Gehrt</td>
<td>87: The effect of moon phase on habitat use and movement of bobcats — Rockhill, DePerno, Powell</td>
</tr>
<tr>
<td>1400</td>
<td>74: Phylegeographic relationships of South American grass mice Akodon (Rodentia, Cricetidae) — Coyner, Braun, Mares, Van Den Bussche</td>
<td>81: Distribution of small mammals and pathogens along an elevational gradient — Mahler, Timm, Peterson, Gage, Schountz</td>
<td>88: Microhabitat selection by bobcats in the badlands region of South Dakota — Mosby, Jenks, Klaver, Grovenburg</td>
</tr>
<tr>
<td>1415</td>
<td>75: Investigation of lice and pinworm coevolutionary histories with chipmunk (Genus Tamias) hosts — Bell, Light, Reid, Sullivan, Cook, Demboski</td>
<td>82: Sizing up big-legged bat flies: A morphometric approach to species boundaries within the genus Megistopoda — Dick, Bindokas, Patterson</td>
<td>89: Ocelot (Leopardus pardalis) latrines yield data on ecology and behavior — Giacalone, Moreno</td>
</tr>
<tr>
<td>1430</td>
<td>76: Landscape genetics of swamp rabbits in southern Illinois — Berkman, Nielsen, Roy</td>
<td>83: Ectoparasite and serosurvey of mountain lions (Puma concolor) in southwestern Arizona — Nicholson, Noon, Krausman</td>
<td>90: Wolverine capture, home range, and movements in northern Southeast Alaska — Lewis, Flynn, Barten</td>
</tr>
<tr>
<td>1445</td>
<td>77: Mitochondrial DNA variation in golden mice (Ochrotomys nutalli) populations from fragmented and continuous landscapes — Smiley, Schrey, Mushinsky, McCoy</td>
<td>84: The ecology, evolution, and host associations of monkeypox — Carroll, Hutson, Olson, Weiss, Gallardo-Romero, Braden, Smith, Kareem, Damon</td>
<td>91: Female reaction to male urine scents as an indicator of mate choice in captive cheetahs (Acinonyx jubatus) — Mossotti, Feldhamer, Asa</td>
</tr>
<tr>
<td>1500</td>
<td>78: Comparative phylogeography of alpine mammals in eastern Beringia — Lanier, Gunderson, Fedorov, Weksler, Olson</td>
<td>85: Prairie dog model of systemic orthopoxvirus disease using West African and Congolese strains of monkeypox — Hutson, Carroll, Olson, Self, Weiss, Hughes, Braden, Abel, Osorio, Hudson, Dillon, Smith, Kareem, Damon, Regnery</td>
<td>92: Contact structure of white-tailed deer in New York: Informing risk models and management decisions. — Williams, Dechen Quinn, Porter</td>
</tr>
<tr>
<td>1515</td>
<td></td>
<td>86: Associations of the tick, Ixodes angustus, on small mammal hosts from South-central and Southeastern Alaska — Nomphissey, Waltari, MacDonald, Runck, Cook, Fitzpatrick, Hanfelt-Goade, Ebel</td>
<td>93: White-tailed deer space use and resource selection: Implications for disease spread — Dechen Quinn, Williams, Porter</td>
</tr>
<tr>
<td>1530-1730</td>
<td>Poster Session 1, Wood Center</td>
<td></td>
<td>94: Red and arctic foxes on the Saint Matthew Islands: Can they coexist? — Klein</td>
</tr>
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</table>
95: Seasonal changes in field metabolic rate, FMR, of captive northern red-backed voles, *Myodes rutilus* — Templin, van Tets
96: Phylogenetic relationships among species of chipmunks (*Tamias*) from the Great Basin and southern Rockies — Demboski, Bell
97: Small-mammal monitoring in Denali National Park and Preserve, Central Alaska Network — Flamme, Debevec, MacCluskie
98: Do naturally occurring differences occur in maternal licking and grooming profiles in rats in semi-natural environments? — Margerum, Francis
99: Variation in the southern short-tailed shrew (*Blarina carolinensis*): A preliminary report — O’Neill, Choate
100: Strange things done under the midnight sun: Echolocation-call characteristics of little brown bats (*Myotis lucifugus*) at the northern edge of their range — Lausen, Jung, Talerico
101: Behavioural responses of hoary marmots (*Marmota caligata*) to alpine hikers in central Yukon — Cadsand, Jung
102: Lousy wolves: Distribution of *Trichodectes cantz*, an invasive ectoparasite of Alaska gray wolves — Walstad, Beckmen, Gardner, Hundertmark
103: Bone mineral density is conserved during hibernation in arctic mammals — Mayfield, Stevenson, Lee, van Tets, Barnes, Toien
104: Dual-energy X-Ray absorptiometry (DXA) can accurately and nondestructively measure the body composition of small, free-living rodents — Stevenson, van Tets
105: Integration of the University of Illinois Collection complements mammalogy at the Museum of Southwestern Biology — Kavanaugh, Dunnum, Gannon, Cook
106: Archival observatory for endangered organisms: Mexican grey wolf (*Canis lupus baileyi*) summaries of contemporary research — McCain, Malaney, Dunnum, Cook
107: Modeling the effects of fire severity on moose population densities and implications for ecosystem services — Carroll, Kielland, Doak
108: Population assessment of golden mice in Illinois: Relative abundance and sympatric white-footed mice — Stetson, Hubert, Feldhamer
109: Investigating the potential impacts of shrub encroachment on arctic ground squirrel (*Spermophilus parryii*) behavior and density — Wheeler, Hik
110: Age dimorphism of pelves of *Sorex sonomae* (Soricomorpha: Soricidae) — Carraway
111: Rising above the conflict: Meadow jumping mice coexist with meadow voles through vertical habitat partitioning — Jacquot, Smith
112: Behavioral ecology and birth control of introduced eastern fox squirrels in California — Krauss, Kelt, Van Vuren
113: Fecal indices in mule deer during winter: Effects of competition with elk — Atwood, Zager, Millsap, Matocq, Bowyer, Kie
114: Differentiation of the broad-clawed shrews (Soricomorpha, Soricidae), *Cryptotis griseoventris* and *C. goodwini*, using skeletal morphology of the fore foot — Stephens, Woodman
115: The nature and significance of fossil and modern food-caches of the arctic ground squirrel (*Spermophilus parryii*) — Gaglioti, Zazula, Barnes
116: Hybridization between *Neotoma fuscipes* and *Neotoma macrotis* in isolated populations of the Central Valley of California — Matocq, Crawford
117: Effect of prescribed burns on East-African savanna small mammals — Bergstrom
118: Modeling occupancy for American mink in human-dominated landscapes — Schooley, Bucci
119: *Hipposideros commersoni*, a Malagasy endemic: Sleeping beauty or seasonal migrant? — Davion, Goodman
120: Survival of North American elk: Costs of reproduction — Morano, Stewart, Sedinger, Vavra
121: Life in the big city: Woodchuck movements and behavior across an urbanization gradient — Watson, Schooley
122: Home range size of the southeastern beach mouse (*Peromyscus polionotus niveiventris*) on the Kennedy Space Center — Oddy, Gann
123: A long term ecological study of small mammals in central Pennsylvania: Three years later — Clinton, Iudica
124: "Treated" vs. new traps: Does chronic application of disinfectant to traps reduce rodent catchability? — Kaufman, Kaufman, Kaufman
125: Effect of roads on movement of Peromyscus leucopus: Field activity for a general ecology class — Pugh, Perkins
126: Annual fires and the deer mouse in tallgrass prairie: A 25-year study — Kaufman, Kaufman
127: Geographic variation and genetic structure in the broad-nosed bat genus Platyrhinus (Chiroptera: Phyllostomidae) — Velazco, Patterson
128: Ecology of small mammals with implications for wetland conservation and restoration — Shenko
129: Seasons of change in Washington, DC: The experiences of the 2008 ASM-AIBS Public Policy Intern — Smiley
130: Diversity of mitochondrial haplotypes on a naturally isolated population of moose on Isle Royale — Sattler, Swanson, Vucetich
131: Mammalogy, ornithology, botany, and the public: Expanding science and natural history education in Historic Bethabara Park — Thorington
132: Arboreal habitat structure affects locomotor performance of white-footed mice (Peromyscus leucopus) — Hyams, Jayne, Cameron
133: Importance of incorporating genetic diversity in mammalian surveys: A case study from Botswana's Koanaka Hills — Ferguson, McDonough, Baker, Thies, Lewis, Gabadirwe
134: Feeding behavior of laboratory reared Onychomys leucogaster (northern grasshopper mice) when offered live food — Worrell
135: Pocket mouse invasion influences desert plant community structure in place of absent kangaroo rats — Mohlman, Ernest
136: Seasonal home ranges and movement patterns of an Iowa species of greatest conservation need — Tapia, Fairbanks
137: Morphological and molecular analysis of populations of Oreoryzomys balneator — Lee, Hanson, Craig, Brant, Platt
138: Effects of landscape alteration on the distribution of Neotoma micropus — Post, Post, Miller, Stacey
139: Resource selection by mule deer on winter range: Effects of space use by elk — Long, Atwood, Zager, Bowyer, Kie
140: Molecular markers to evaluate the effectiveness of feral pig (Sus scrofa) damage control — Delgado-Acevedo, Zamorano, DeYoung, Campbell, Long
141: Ixodes scapularis burdens of Peromyscus leucopus and tick infection by Borrelia burgdorferi in southwestern Maine — Rogers, Barry, Pradhan
142: Linkages between large-scale climate patterns and the dynamics of arctic ungulate populations — Joly, Klein, Verbyla, Rupp, Chapin

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1800-2000 Picnic, Pioneer Park (transportation will be provided, leaving from Wood Center bus stop; cash bar)
1900-2400 UAF Pub (host bar; beer, wine, and soft drinks only)

Saturday, 27 June

0630-0800 Gordon Kirkland Memorial Run/Walk for Research, West Ridge Ski Hut (start)
0830-1000 Technical Session 13 — Biogeography 2, Davis Concert Hall (Chair: Felisa Smith)
0830-156: Technical Session 15 — Behavior 3, Wood Center Ballroom (Chair: Karen Munroe)
143: Boreal forests, land use, and white-tailed deer (Odocoileus virginianus) range expansion — Dawe, Boutin
144: Size matters: Examining patterns of maximum body size of mammals over time and space — Smith, Boyer, Brown, Costa, Dayan, Evans, Ernest, Fortelius, Harding, Lintulaakso, Lyons, Sibly, Saarinen, Theodor, Uhen
149: Estimating historical demography in the banner-tailed kangaroo rat (Dipodomys spectabilis) (Undergraduate Student Research Award) — McCreight, Busch, DeWoody, Waser
150: Assessing individual identification, relatedness, temporal and spatial structuring of brown bears in Katmai National Park and Preserve — Turner, Graziano, Olson, Hamon, Nielsen
155: A test of sociality complexity models in round-tailed ground squirrels (Spermophilus tereticaudus): Insight from microsatellite analysis — Munroe, Koprowski
156: Spatial organization of Glaucomys sabrinus: Territory and habitat use — Smith, Kelt, Van Vuren, Johnson
| 0900 | 145: Analyzing and visualizing the 4-dimensional relationships between terrestrial species and environment — Marcus, Malzoe |
| 0915 | 146: Diversity gradients resulting from niche conservatism are a product of complex interactions between climate and history — Stevens |
| 0945 | 148: Influence of roads on home range and movements of urban coyotes — Brown, Gehrt |

| 1000-1030 | Refreshment Break, Great Hall |
| 1030-1200 | Members Meeting II, Davis Concert Hall |
| 1200-1330 | Lunch, Lola Tilly Commons or Wood Center; Poster Switchover |
| 1200-1400 | Board of Directors Meeting II, Wood Center E & F |

| 1330-1500 | Technical Session 16 — Phylogeography, Davis Concert Hall (Chair: Natalie Dawson) |
| 1330 | 161: Phylogenetics of *Rousettus aegyptiacus* and Marburg hemorrhagic fever virus in central Africa — Carroll, Stanley, Towner, Sealy, Amman, Rollin, Nichol |
| 1345 | 162: The fate of alpine specialists in a changing world: Phylogeography of the American pika — Galbreath, Hafner, Zamudio |
| 1400 | 163: Genetic differentiation and the evolution of late breeding in coastal mink (*Neovison vison*) — Fleming, Cook |
| 1415 | 164: Mustelid diversification along the North Pacific Coast — Dawson, Talbot, Fleming, Cook |
| 1430 | 165: Characterization of a contact zone in California voles (*Microtus californicus*) with mtDNA, nDNA, and morphology — Conroy, Gupta, Smith |

| 1515 | 166: New insights from old lions: The ‘Man-eaters of Tsavo’ revisited — Patterson, Yeakel, Dominy |
| 1530 | 167: Ecological scale, density-dependent habitat selection, and coexistence of *Myodes gapperi* and *Peromyscus keeni* — Smith |
| 1545 | 168: Coexistence patterns in a desert rodent community — Yenni |
| 1555 | 169: Hispid cotton rats as a source of mortality to pine trees invading an oldfield — Rose |
| 1600 | 170: “Some like it hot”: Hibernation pattern of the subtropical greater mouse-tailed bat (*Rhinopoma microphyllum*) — Levin, Yom-Tov, Kronfeld-Schor, Ar |
| 1615 | 171: Multi-scale habitat selection of a reintroduced American Marten (*Martes americana*) population — Buchanan, Swanson |
| 1630 | 172: Characterization of a contact zone in California voles (*Microtus californicus*) with mtDNA, nDNA, and morphology — Conroy, Gupta, Smith |

<p>| 1650 | 173: Body temperature patterns during hibernation in free-living Alaska marmots (<em>Marmota broweri</em>) — Lee, Barnes, Buck |
| 1665 | 174: Effect of manipulated den temperatures on body temperature cycling in hibernating black bears (<em>Ursus americanus</em>) — Toien, Blake, Barnes |
| 1680 | 175: Active season changes in resting metabolic rate and body composition of free-living arctic ground squirrels — Buck, Fridinger, Toien, Barnes |
| 1700 | 176: “Some like it hot”: Hibernation pattern of the subtropical greater mouse-tailed bat (<em>Rhinopoma microphyllum</em>) — Levin, Yom-Tov, Kronfeld-Schor, Ar |
| 1715 | 177: Seasonal change in bone mineral density in a non-hibernating Alaskan rodent — Stevenson, van Tets, Chon |</p>
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<th>Time</th>
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<tr>
<td>1445</td>
<td>166</td>
<td>Phylogeography and systematics of select South American sigmodontine rodent taxa</td>
<td>Palma, Rodriguez-Serrano</td>
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<tr>
<td>1450</td>
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<td>Refreshment Break, Great Hall</td>
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<td>1500</td>
<td>1500-1530</td>
<td>Technical Session 19 — Biogeography/phylogeography/systematics, Davis Concert Hall (Chair: Brandi Coyner)</td>
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<tr>
<td>1530</td>
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<td>Technical Session 20 — Physiology 2, Schaible Auditorium (Chair: Eileen Lacey)</td>
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<td>1545</td>
<td></td>
<td>Technical Session 21 — Conservation 3, Wood Center Ballroom (Chair: Andrew Van Eck)</td>
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<tr>
<td>1600</td>
<td>179</td>
<td>Genetics and taxonomy of moose: One or two species?</td>
<td>Hundertmark, Bowyer</td>
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<tr>
<td>1615</td>
<td>180</td>
<td>Tracing the dispersal history of <em>Rattus rattus</em> and <em>R. norvegicus</em> in the U.S.</td>
<td>Van Den Bussche, Fite, Lack, Hamilton, Braun, Mares</td>
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<tr>
<td>1630</td>
<td>181</td>
<td>Are multiple invasions required to explain the diversity of <em>Myotis</em> of the Lesser Antilles?</td>
<td>Larsen, Larsen, Genoways, Kwiecinski, Pedersen, Catzeflis, Baker</td>
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<tr>
<td>1645</td>
<td>182</td>
<td>Ecological speciation in Central American fruit-eating bats (genus <em>Artibeus</em>)</td>
<td>Larsen, Marchán-R, Baker</td>
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<tr>
<td>1700</td>
<td>183</td>
<td>Molecular divergence in the <em>Oryzomys palustris</em> complex: Evidence for multiple species</td>
<td>Hansoo, Indorf, Swier, Bradley</td>
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<tr>
<td>1715</td>
<td>184</td>
<td>Molecular systematics of the brush-tailed mice of the family Calomyscidae</td>
<td>Kilpatrick, Norris</td>
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<tr>
<td>1730</td>
<td>185</td>
<td>Do gender and size affect survivorship and site fidelity in Death Valley Neotoma?</td>
<td>Lease, Harding, Martin, Murray, Smith</td>
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<tr>
<td>1745</td>
<td>186</td>
<td>Ecological predictors of delayed implantation in Carnivora</td>
<td>Orr, Lindenflors, Dales, Angerbjoern, Garland</td>
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<tr>
<td>1755</td>
<td>187</td>
<td>Social mole-rats as aging models - what we have learned, and what is yet to come</td>
<td>Dammann, Begall, Koeppe, Burda</td>
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<tr>
<td>1750</td>
<td>188</td>
<td>Physiological consequences of group living in a plural-breeding rodent</td>
<td>Woodruff, Lacey</td>
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<tr>
<td>1800</td>
<td>189</td>
<td>Elevation variation in life-history characteristics of populations of yellow-bellied marmots (<em>Marmota flaviventris</em>)</td>
<td>Woods, Brown, Cobb</td>
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<tr>
<td>1830</td>
<td>191</td>
<td>Fragmentation and hunting: Deciphering the impacts on mammals in SE Bolivia</td>
<td>Van Eck</td>
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<tr>
<td>1845</td>
<td>192</td>
<td>Science and values influencing predator control programs for moose hunters</td>
<td>Boertje, Keech, Paragi</td>
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<tr>
<td>1855</td>
<td>193</td>
<td>Influence of sex, age and winter severity on mountain goat survival in coastal Alaska</td>
<td>White, Pendleton, Crowley, Griese, Hundertmark, McDonough, Nichols, Porter, Robus, Smith, Schoen</td>
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<tr>
<td>1865</td>
<td>194</td>
<td>Space use and linear home-range sizes of riparian muskrats in an agricultural landscape</td>
<td>Ahlers, Schooley, Heske, Mitchell</td>
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<tr>
<td>1875</td>
<td>195</td>
<td>Site occupancy for riparian muskrats in relation to stream characteristics and environmental change</td>
<td>Bucci, Schooley</td>
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<tr>
<td>1900</td>
<td>196</td>
<td>An incidence of elevation-caused home range overlap by two populations of white-tailed deer, <em>Odocoileus virginianus</em></td>
<td>Joachim</td>
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<tr>
<td>1910</td>
<td>197</td>
<td>Testing the coastal refugium hypothesis: A comparative phylogeography approach along the North Pacific Coast</td>
<td>Sawyer</td>
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<tr>
<td>1920</td>
<td>198</td>
<td>Home ranges of northern grasshopper mice in prairie-dog colonies: Implications for the spread of plague</td>
<td>Stapp, Cardinal, Kraft</td>
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<tr>
<td>1930</td>
<td>199</td>
<td>Microscopic hair identification: The mammalian fingerprint</td>
<td>Santana</td>
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<tr>
<td>1940</td>
<td>200</td>
<td>Analysis of interspecific sperm competition and aggregation in <em>Peromyscus</em></td>
<td>Fernandes, Tribble, Dewey, Crossland, Szalai</td>
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<tr>
<td>1950</td>
<td></td>
<td>Pre-Banquet Social, Westmark Hotel &amp; Conference Center (cash bar)</td>
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<tr>
<td>1900-2030</td>
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<td>Annual Banquet, Westmark Hotel &amp; Conference Center</td>
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<tr>
<td>2100-2300</td>
<td></td>
<td>Live Auction and Social, Westmark Hotel &amp; Conference Center (cash bar)</td>
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**Sunday, 28 June**

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<th>Time</th>
<th>Session</th>
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<th>Authors</th>
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<td>0830</td>
<td>Poster Session 2, Wood Center</td>
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196: An incidence of elevation-caused home range overlap by two populations of white-tailed deer, *Odocoileus virginianus* — Joachim
197: Testing the coastal refugium hypothesis: A comparative phylogeography approach along the North Pacific Coast — Sawyer
198: Home ranges of northern grasshopper mice in prairie-dog colonies: Implications for the spread of plague — Stapp, Cardinal, Kraft
199: Microscopic hair identification: The mammalian fingerprint — Santana
200: Analysis of interspecific sperm competition and aggregation in *Peromyscus* — Fernandes, Tribble, Dewey, Crossland, Szalai
201: Diurnal resting habitat selection of the white-tailed jackrabbit in an intensive agricultural setting — Kilburg
202: Charismatic mammalian megafauna: Public empathy and marketing strategy revisited — Feldhamer
203: Cortisol levels from hair and saliva in dogs, Canis familiaris — Ward, Hayssen
204: Functional genomics of winter hibernation in the black bear Ursus americanus — Goropashnaya, Fedorov, Toien, Stewart, Barnes
205: Do male house mice discriminate between females that differ in their ability to retrieve pups? — Costello, Pultorak, Meikle
206: Current status and interspecific associations of the dark kangaroo mouse, Microdipodops megacephalus, in Utah — McMillan, Haug, Auger, Black
207: Post-release survival of captive American marten (Martes americana caurina) — Stansbury, Pauli, Mares, Ben-David
208: Larger deer mice are darker than smaller deer mice across the genus Peromyscus — Waterman, Urrutia, Hayssen
209: Mammalogy at the U.S. Air Force Academy — Hale, Mihlbachler, Pigage, Unangst
211: The impact of roadways on mammals in northern New York — Barthelmess, Brooks
212: Foraging behavior of white-footed mice (Peromyscus leucopus) in relation to their perception of predation risk — Marcello, Meikle
213: David and Goliath: Ant symbionts buffer against megaherbivore-driven landscape change in an African savanna — Goheen, Palmer, Maclean
214: A genetic analysis of Virginia opossum mating systems — Beasley, Beatty, Rhodes
215: The impact of biological invasions on river otters and aquatic-terrestrial linkages in Yellowstone Lake — Crait, Ben-David
216: Indices to estimate body fat content in harvested populations of wolverine (Gulo gulo) — Robitaille, Villano, Jung, Oakley, Slama
217: Intraspecific pilfering in larder-hoarding red squirrels, Tamiasciurus hudsonicus — Donald, Boutin
218: Phylogenetic relationship between feral pigs in the USA — Delgado-Acevedo, Zamorano, DeYoung, Campbell
219: Small mammals from a cloud forest in the Montañas del Cuielco, Huehuetenango, Guatemala — Matson, Bulmer, Eckerlin, Lanier, Woodman
220: Geometric morphometric analysis of jaw shape in foxes — Scheibe, Feldhamer, Barko, Carter
221: Seasonal movements and altitudinal migration of reintroduced wood bison (Bison bison athabascae) in Yukon, Canada — Clyde, Jung, Oakley, Egli
222: Identifying hybrids of Peromyscus leucopus and P. maniculatus in Michigan using molecular genetics — Schumacher, Norris, Jacquot, Swanson
223: Signatures of high-altitude adaptation in the major hemoglobin — McCracken, Barger, Bulgarella, Johnson, Trucco, Valqui, Wilson
224: Inter- and intraspecific variation in personality in two species of sympatric Peromyscus — Torgerson, McAdam, Lundrigan
225: Distribution and movements of moose (Alces alces) in the Upper Koyukuk River Drainage, Alaska — Saperstein, Joly, Craig, Hollis, Stout
226: Ultrasonic vocalization in Glaucomys sabrinus — Youngblood, Scheibe
227: Assessing the predictors of mink dynamics in Quebec, Ontario and Manitoba — Sundaram, Swanson
228: Is short-term active acoustic sampling sufficient to determine bat species presence? — Bender, Castleberry, Miller, Wigley
229: Comparison of kernel density and local convex hull methods for estimating utilization distributions — Lichti, Swihart
230: Why do beavers abandon their lodges? — Donkor, Buttler
231: Dietary selection in the least shrew Cryptotis parva and factors affecting preferences — van den Heever, Carr, McCoy
232: Fleas (Siphonaptera) from a small mammal community in a Guatemalan cloud forest — Eckerlin, Bulmer, Lanier, Matson, Woodman
233: Does avpr1a microsatellite length influence parental care in male prairie voles? (Undergraduate Student Research Award) — Kelley
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<tr>
<th>1000-1030</th>
<th>Refreshment Break, Great Hall</th>
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<tr>
<td>1030-1145</td>
<td>Technical Session 22 — Systematics, Davis Concert Hall (Chair: Kristofer Helgen)</td>
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<tr>
<td>1030</td>
<td>243: Phylogenetic systematics of the genus <em>Holochilus</em> based on mitochondrial and nuclear data — Mauldin, Hanson, D’Elía, Teta, Pardiñas</td>
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<tr>
<td>1045</td>
<td>244: Molecular phylogenetics of Reig’s short-tailed opossum (<em>Monodelphis reigi</em>) and its distributional range extension into Guyana — Lim, Engstrom, Patton, Bickham</td>
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<tr>
<td>1100</td>
<td>245: Molecular phylogenetics of <em>Myotis</em> and taxonomic changes to the position of <em>Cistugo</em> and <em>M. latirostris</em> — Lack, Roehrs, Van Den Bussche, Ruedi</td>
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<tr>
<td>1115</td>
<td>246: <em>Lonchophylla</em> of Ecuador: Evaluating congruence of morphological and genetic data — Parlos, Swier, Mantilla-Meluk, Baker</td>
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<tr>
<td>1130</td>
<td>247: What is a species, how are they recognized, and what good are they? — Baker, Bradley</td>
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<tr>
<td>1145-1330</td>
<td>Lunch, Lola Tilly Commons or Wood Center</td>
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<td>1330-1515</td>
<td>Technical Session 25 — Alaska EPSCoR landscape genetics student session 2, Davis Concert Hall (Chair: Link Olson)</td>
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<tr>
<td>1330</td>
<td>258: Estimating deer density in Alaska using DNA from fecal pellets — Brinkman, Person, Hundertmark</td>
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<tr>
<td>1345</td>
<td>259: Fine scale genetic structure of a large ungulate in Alaska — Colson, Brinkman, Person, Hundertmark</td>
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<tr>
<td>1350-1500</td>
<td>Technical Session 26 — Population ecology, Wood Center Ballroom (Chair: George Feldhamer)</td>
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<td>1350</td>
<td>265: Development of an index for estimating abundance in pygmy rabbit populations — Price, Rachlow</td>
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<td>1355</td>
<td>266: Density of white-tailed deer at Vicksburg National Military Park — Bomar, Kissell</td>
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<td>Time</td>
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<tr>
<td>1400</td>
<td>260: Landscape genetics of feral pigs in southern Texas — Delgado-Acevedo, DeYoung, Campbell</td>
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<tr>
<td>1405</td>
<td>261: Genetics used to explain variation in grizzly bear abundance — Graves, Kendall, Royle, Stetz, Macleod</td>
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<tr>
<td>1430</td>
<td>262: Phylogeography of Matschie's Tree Kangaroo (<em>Dendrolagus matschiei</em>) from Huon Peninsula, Papua New Guinea — McGreevy, Dabek, Husband</td>
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<tr>
<td>1445</td>
<td>263: Population structure of an arctic ice seal: Support for conservative management — Ponce, Kelly, Sell, Swanson, Tallmon</td>
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<tr>
<td>1500</td>
<td>264: The Andes Mountains, human impact, and the genetic structure of vampire bats — Pinto, Mantilla-Meluk, Hoofer, Baker</td>
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<tr>
<td>1500-1530</td>
<td>Refreshment Break, Great Hall</td>
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<tr>
<td>1545-1645</td>
<td>Capstone Session 1, Davis Concert Hall (Chair: Nancy Solomon)</td>
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<tr>
<td>1700-1900</td>
<td>Dinner, on your own or Lola Tilly Commons</td>
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<tr>
<td>1900-2030</td>
<td>Capstone Session 2, Davis Concert Hall (Chair: Nancy Solomon)</td>
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<tr>
<td>1000-1400</td>
<td>Large Animal Research Station, Permafrost Tunnel, and Pipeline Viewpoint Field Trip (4 hours)</td>
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<tr>
<td>1500 Mon-2300 Tues</td>
<td>Denali National Park Field Trip (2 days)</td>
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Monday, 29 June

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<td>1400</td>
<td>268: Population dynamics of white-footed mice (<em>Peromyscus leucopus</em>) in a tornado-impacted forest in southern Illinois — Rodman, Feldhamer</td>
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<tr>
<td>1415</td>
<td>269: Maternal programming, prenatal stress, and the 10-year snowshoe hare cycle — Sheriff, Krebs, Boonstra</td>
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<td>1430</td>
<td>270: Interannual variation in sensitivities of vital rates of old-field rodents — Reed, Slade</td>
</tr>
<tr>
<td>1445</td>
<td>271: Small mammals in shortgrass prairie in Texas: Composition, abundance and dynamics — Priesmeyer, Matlack, Hathaway, Bogrand</td>
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</table>
1: Evolutionary forces favoring intragroup coalitions in the spotted hyena (*Crocuta crocuta*) (Anna M. Jackson Award)

Jennifer E. Smith. 203 Natural Science Building, Michigan State University, East Lansing, MI 48824

Coalitionary support in agonistic interactions represents a cooperative act; intervening in a fight is potentially costly to the donor of support, but benefits the recipient. I test hypotheses suggesting kin selection, reciprocal altruism, and direct benefits as explanations for coalitionary interventions among adult female spotted hyenas (*Crocuta crocuta*) in Kenya. I found no evidence of reciprocal altruism among unrelated adult females. Instead, females made flexible decisions based on multiple factors. As predicted by kin selection theory, females supported close kin most often, and the density (connectedness) of cooperation networks increased with genetic relatedness. Nevertheless, kinship failed to protect females from coalitionary attacks, which females most often directed towards subordinate individuals to reinforce the status quo. Donors minimized costs to themselves by intervening most often during fights of low intensity when feeding opportunities were unavailable. Finally, females monitored the number of dominant bystanders, a proxy for the risk of retaliation, and modified their level of cooperation based on knowledge of this and their genetic relationship to potential beneficiaries. Overall, my findings suggest that the combined evolutionary forces of kin selection and direct benefits of reinforcing the status quo favor interventions among adult female spotted hyenas.

2: Diversification of silky pocket mice in the *Perognathus flavus* species-group: Implications for the biogeography of North American arid grasslands (Elmer C. Birney Award)

Sean A. Neiswenter and Brett R. Riddle. University of Nevada, Las Vegas, 4505 Maryland Parkway, Las Vegas, NV 89154-4004

We investigate the evolutionary history of a group of silky pocket mice (Heteromyidae: Perognathinae: *Perognathus flavus* species-group) to determine patterns and postulate causes of geographical diversification across western North American arid grasslands and intermontane basins - a topographically complex landscape that has experienced a wide range of historical climatic variation. Nuclear and mitochondrial DNA were used in assessing the geography and timing of diversification of discrete evolutionary lineages within the *P. flavus* species-group. Bayesian and maximum-likelihood phylogenetic analyses support an initial split between four major lineages, estimated using a relaxed molecular clock approach to have occurred in the late Miocene. Within the two widespread lineages further geographical diversification was likely to have begun during the Pliocene, which coincides with several hypothesized geographic barriers. These patterns are consistent with models of allopatric divergence driven by pre-Pleistocene geologic and climatic events, particularly the late Miocene expansion of interior grasslands and Mio-Pliocene evolution of Basin and Range geomorphology. To the degree that diversification in the *P. flavus* species-group is associated with geomorphological and paleoclimatic histories, biogeographic structure may be predictive for a range of co-distributed taxa.

3: Molecular and environmental characterization of a woodrat hybrid zone: Evidence for habitat segregation among genotypic classes (A. Brazier Howell Award)

Quinn R Shurtliff¹ and Marjorie D Matocq². ¹Dept. of Biology, Idaho State University, Pocatello, ID, ²Dept. Nat. Resources and Env. Science, University of Nevada, Reno, NV

Modern molecular techniques and analytical methods provide important insights into our understanding
of the impact that hybridization has had on the diversification of animal life throughout evolutionary history. Hybrid zone models provide a conceptual framework that can be useful for testing hypotheses regarding the predicted outcomes of hybridization under varying ecological, behavioral, and genetic constraints. Here, I test predictions of 3 models by genetically characterizing an admixed population of desert woodrats in a newly described hybrid zone between *Neotoma bryanti* and *N. lepida*. I also incorporate spatial and habitat data in order to test model predictions regarding the distribution of genotypes across the landscape. Analyses indicate that at least 13% of individuals are hybrids, and that F₁, F₂, and backcrosses are present. The 2 parental populations and associated backcrosses are highly segregated by habitat type, and there is evidence that the 2 parental populations respond differently to drought conditions. The evolutionary novelty model is best supported by the data, although additional fitness information is necessary to rule out the bounded hybrid superiority model.

4: Delayed dispersal and resource abundance in solitary kangaroo rats: Implications for family formation in mammals (Shadle Fellow)

Andrew J Edelman. Department of Biology, University of New Mexico, Albuquerque, NM 87131

Formation of family groups results when nutritionally independent offspring postpone dispersal, extending the association with one or both parents. Families are predicted to form when parents have access to necessary resources to support offspring past the age of independence. Most research on delayed dispersal in mammals has focused on group-living species, many of which postpone reproduction and cooperatively breed. However, numerous solitary species also engage in delayed dispersal indicating that group-living and indirect fitness benefits are not necessary for this behavior to evolve. I studied the solitary banner-tailed kangaroo rat (*Dipodomys spectabilis*), a species with nepotistic behavior that forms primitive families (i.e., mother and offspring). This species exhibits considerable variation in timing of dispersal with respect to both age and body mass. I tested the following hypotheses in relation to resource abundance and families: (1) resource abundance affects the length of time offspring spend with mothers, thereby contributing to family formation; and (2) the effect of resource abundance on offspring is mediated through access to maternal resources. I used comparisons between years of natural high and low resource abundance and experimental food supplementation to examine the effect of resources on timing of juvenile dispersal.

5: Temporal consistency and spatial heterogeneity in the tempo of speciation among SE Asian shrews (ASM Fellow)

Jacob A Esselstyn. Biodiversity Research Center and Department of Ecology and Evolutionary Biology, University of Kansas

Island archipelagos, with their discrete nature and typically well-understood geological histories, offer a multitude of opportunities for studying speciation. Shrews of the genus *Crocidura* (Soricomorpha: Soricidae) are widespread among the islands of SE Asia and thus represent a powerful model system for understanding the effects of geological and climatic history on the process of phylogenetic diversification. I use a multilocus phylogenetic analysis to infer the topology of SE Asian *Crocidura*, estimate regional species-level diversity, and infer patterns of island colonization. Further analyses of phylogenetic tree shape suggest speciation rates in SE Asian shrews have been relatively constant or experiencing statistically insignificant temporal declines through time. These findings are somewhat unusual as most clades with well-sampled phylogenies reveal significant declines in speciation rates through time. Across geography, speciation rates in *Crocidura* appear to have been faster in insular than in continental clades.
6: Marsupial tales: Diversity, demography, and interactions among the carnivorous marsupials of Australia

Christopher R. Dickman. Institute of Wildlife Research, School of Biological Sciences, University of Sydney, NSW 2006, Australia

With 56 species in Australia and 13 more in New Guinea, the Dasyuridae is the largest family of marsupials in the Antipodes. Ranging in size from 4 - 15,000 g, dasyurid marsupials specialize in hunting insects and vertebrate prey as large as themselves. In this presentation I will outline some of the major discoveries and insights into the biology of this group that have occurred over the last 25 years. Highlights include the discovery of 12 new species, disentangling the roles of competition, predation and facilitation in structuring many dasyurid communities, uncovering causes of male semelparity in at least four genera, defining the role that photoperiod plays in driving the 'clockwork' life cycles of many dasyurids, and gaining insights into unexpectedly large movements, stochastic population dynamics and positive interactions among species that characterize dasyurids of the Australian deserts. Using studies of competition, reproduction and population dynamics within the genus Antechinus over the last 25 years, I will then present a model of sympatric speciation that can explain the evolution of the smallest Antechinus, A. agilis. Taken together, these and other observations suggest that dasyurids can be viewed as 'model' organisms for many areas of ecological, physiological and evolutionary inquiry.

7: Enhancing education about the science and natural history of mammals

Mark Brigham. Department of Biology, University of Regina, Regina SK S4S 0A2 Canada

My intent is to give a practical and educational talk about giving "talks". I will provide points for contemplation aimed at improving communication about Mammals to our peers, undergraduate students and the general public. This is especially timely given that "slideware" has taken over meetings and classrooms. My presentation will have 3 components; a short talk about some recent research presented as "badly" as I can, followed by the same material presented as "well" as I can. I will conclude with explicit opinions about how Mammalogists can ensure the intended take home message(s) from oral presentations is clearly received by the audience. This will include specific suggestions about how "slideware" can supplement presentations. Misuse of PowerPoint ignores the critical rule of speaking: respect your audience. If words or images are not to the point, having them dance in colour will not make them relevant. While, some may be offended by my use of this auspicious occasion for such a purpose, my motivation arises from Joseph Grinnell's focus on education. I want to hear my peers give better talks about good science and help Mammalogists better inform the public about research and amazing animals. I hope he would approve.

8: Biogeographic relationships and diversification processes among montane populations of Myosorex in Tanzania

William T. Stanley and Jake Esselstyn. ¹Department of Zoology, Field Museum of Natural History, 1400 South Lake Shore Drive, Chicago, IL 60605, ²Biodiversity Research Center, Department of Ecology & Evolutionary Biology, University of Kansas, 1345 Jayhawk Blvd., Lawrence, KS 66045

The biogeography of montane organisms residing in Tanzania and neighboring countries is complex, perhaps due to the varied origin of mountains in the region. Some mountains are volcanic and relatively young, such as Mt. Kilimanjaro and the Southern Highlands, whereas others are old fault-block mountains, as exhibited in the Eastern Arc Mountains (EAM). Unfortunately, the potential significance
of geologic and climatic processes on the diversification of East African small mammals has never been critically examined. We analyzed variation in morphological and molecular characters among three species of *Myosorex* (the mouse shrew) distributed across the montane archipelago of Tanzania. We analyzed seventeen cranial and dental characters using principal components and performed phylogenetic analyses on sequences of mitochondrial and nuclear DNA. Our results suggest that isolated populations of *Myosorex* on one side of the Rufiji/Ruaha River are distinct from populations on the other. These patterns are in agreement with other recent studies illustrating the close relationship between faunas of the Southern Highlands and the southern Eastern Arc Mountains, and diminishing the "Makambako Gap" as a biogeographic entity.

9: "Antique" DNA illuminates broad-scale geographic patterns in the *Tupaia belangeri*/*Tupaia glis* species group

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The closely related treeshrews *Tupaia belangeri* and *T. glis* are currently delineated geographically by the Isthmus of Kra, but this arrangement is acknowledged to be a probable oversimplification of a more complex species group. These two species encompass more than 50 synonyms, many referring to geographically localized or island forms. Using mitochondrial DNA sampled non-destructively from museum specimens, we present the first broad phylogeographic analysis of lineages within the *T. belangeri*/*T. glis* complex, highlighting three major patterns. First, northwestern *T. belangeri* specimens are more closely related to *T. glis*, rendering *T. belangeri* paraphyletic. Second, well-defined geographic clades exist within both recognized species, but not all named forms correspond to separate mitochondrial lineages. Third, *T. glis* specimens from Pulau Bangka fall outside the *T. belangeri*/*T. glis* complex entirely and are more closely related to *T. longipes* and *T. chrysogaster*. These results begin to clarify the diversity and evolutionary history of this widespread species group and provide a phylogenetic context for additional treeshrew research.

10: Environmental and geometric drivers of small mammal diversity along an elevational gradient in the Great Basin

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The mechanisms shaping biodiversity patterns along spatial gradients remain poorly known and controversial. Even for the same taxonomic group, numerous studies have documented variation in both diversity patterns and underlying processes across multiple gradients, at regional and global scales. Much of this uncertainty may be attributed to the scarcity of studies evaluating pattern and process while controlling for methodology. In this study, we test whether the processes driving diversity are consistent along an elevational gradient when the pattern of diversity is obtained using a series of different methods (e.g., local site based counts versus extrapolated ranges). The data are for non-volant small mammals ( rodents & shrews), from a recent (2006-2008) field survey along a local gradient in Lamoille canyon on the western slope of the Ruby Mountains, northeastern Nevada. We construct multiple regression models to assess the relative role of both environmental (temperature, precipitation, productivity &
habitat diversity) and geometric drivers, and apply Akaike's Information Criterion (AIC) as the method for model selection.

11: Small mammals of the Central Cordillera, Luzon: Discovery, diversity, and survival

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The small mammals of the Central Cordillera of Luzon were poorly known for decades, but intensive surveys from 2000 to 2008 have yielded extensive new information. We have discovered 2 previously unknown mammals in the genus Archboldomys and one in a newly-discovered genus, rediscovered two "lost" species in the genus Carpomys, and gathered extensive data on species in the endemic and poorly-known Philippine genera Apomys, Batomys, Chrotomys, Crateromys, Phloeomys, and Rhynchomys. Most of the species are members of just two endemic clades, the "cloud rats" and the "earthworm mice", each of which has diversified greatly. In natural habitat, maximum species richness occurs at about 2,200 meters elevation, and is lower above and below this level. Up to seven "earthworm mice" and up to five "cloud rats" can occur syntopically, accounting for much of the total mammalian diversity. Individual species show their greatest tolerance to anthropogenic habitat disturbance at the elevation where they are naturally most abundant; most and perhaps all of the species can tolerate some disturbance. The species most seriously threatened by extinction are those that are heavily hunted. Local extinction of species that are common in natural habitats is associated with forest fragmentation, degradation, and/or removal.

12: Fire drives transcontinental variation in tree birch defense against browsing by snowshoe hares

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Fire has been the dominant disturbance in boreal America since the Pleistocene, resulting in a spatial mosaic in which the most fire occurs in the continental northwest. Spatial variation in snowshoe hare (Lepus americanus) density reflects the fire mosaic. Because fire initiates secondary forest succession, a fire mosaic creates variation in the abundance of early successional plants that snowshoe hares eat in winter, leading to geographic variation in hare density. We hypothesize that fire is the template for a geographic mosaic of natural selection: where fire is greatest and hares are most abundant, hare browsing has most strongly selected juvenile-phase woody plants for defense. We tested the hypothesis at multiple spatial scales using Alaska birch (Betula neoalaskana) and white birch (B. papyrifera). We also examined five alternative hypotheses for geographic variation in antibrowsing defense. The fire-hare-defense hypothesis was supported at transcontinental, regional, and local scales; alternative hypotheses were rejected. Our results link transcontinental variation in species interactions to an abiotic environmental driver, fire. Intakes of defense toxins by Alaskan hares exceed that by Wisconsin hares,
suggesting that the proposed selection mosaic may coincide with a geographic mosaic of coevolution.

13: Globetrotting: Patterns of similarity in mammalian distributions across continents

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What characteristics predispose mammals to be successful migrants? Is there an optimal body size or ecological specialization that facilitates the movement of species across space? Here, we employ a global database of late Quaternary mammals that includes mass, distribution, general ecology and phylogenetic association to examine the overlap in species distributions across the four major continents (Africa, Eurasia, North America, South America) at multiple levels of the taxonomic hierarchy. We include both volant and nonvolant mammals, but exclude humans and anthropogenic-mediated introductions. Our results suggest that less than 5% of the species present since the late Quaternary are found on more than one continent, and only four species have distributions encompassing more than two continents; no non-introduced mammal is found on all continents except humans. Given the low overlap in shared taxa, we discuss the potential roles that body size, ecology, geography and phylogeny play in driving observed continental species distributions.

14: Aggressive defensive behavior by free-ranging white-tailed deer

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Maternal defense has been documented in numerous North American ungulates; however, limited information documenting ungulate aggression in defense of neonates directed toward humans exists in the ecological literature. During neonate capture in spring 2007 and 2008 in north-central South Dakota, we documented 24 aggressive encounters by adult female and yearling male and female white-tailed deer (*Odocoileus virginianus*) defending neonates. Eleven (45.8%) aggressive encounters included yearlings accompanying does, including 3 documented encounters by yearling males. Mean age of neonates during aggressive and nonaggressive encounters was 6.7 (SE = 0.57, n = 24) and 1.7 days (SE = 0.31, n = 25), respectively, and was significantly greater (*P* < 0.0001) for neonates during aggressive encounters; age at which adults began protecting neonates was approximately 4.0 days. Mean weight of neonates during aggressive and nonaggressive encounters was 4.4 (SE = 0.18, n = 24) and 2.9 kg (SE = 0.08, n = 25), respectively; weight was significantly greater (*P* < 0.0001) for defended neonates. Male fawns were more likely (*P* = 0.013) to be defended during capture and handling than female fawns. We hypothesized that sex- and age-biased maternal defensive behavior exists in white-tailed deer; deer biased maternal investment toward older, male neonates.
15: Effects of avpr1a on social and genetic mating patterns in semi-natural populations of prairie voles

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Previous studies demonstrate that single genes can play a substantial role in modulating complex social behavior. The peptidergic arginine vasopressin appears to be a key component in social behavior of male mammals, including social attachment to females, through its action on the vasopressin 1a receptor (V1aR). However, most studies of the effects of the gene encoding V1aR (avpr1a) on social behavior have been conducted in laboratory settings. Thorough understanding of the extent to which V1aR influences behavior requires investigating the consequences of avpr1a polymorphism in nature. We examined the relationship between avpr1a length and monogamy among male prairie voles from semi-natural populations during a period representative of their natural lifespan. Density was also manipulated to investigate whether monogamy was influenced by this demographic factor. There was a significant effect of density but not avpr1a microsatellite length on some indices of social monogamy. Interestingly, we found that males with shorter avpr1a microsatellites had significantly more mates and more offspring than males with longer avpr1a microsatellites. Thus, results from field studies can substantially increase our understanding of the effects of genes and environment on social behavior since effects seen in laboratory studies may not reflect behavior in nature.

16: Scent marking and individual discrimination in raccoons (Procyon lotor)

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Although raccoons were originally categorized as solitary carnivores, recent evidence shows that some raccoons have overlapping home ranges, travel in groups, and share dens. Moreover, all raccoons use communal latrines and scent mark, suggesting that chemical signals may be important for communication. In this study we examined patterns of scent marking in five captive raccoons at the Henry Doorly Zoo. Additionally, using the habituation discrimination technique we investigated whether raccoons can discriminate individual differences in the odors of urine or feces. The subjects in the latter experiment were wild-caught (N = 10) and tested in a large outdoor enclosure. In the first experiment, we observed differences in frequency of scent marking based on location and sex. In the second experiment, we demonstrated that raccoons can distinguish individual differences in the odors of unfamiliar and unrelated conspecific urine but not feces. This is the first study to quantify patterns of scent marking in raccoons and to determine that raccoons can distinguish individual differences in chemosensory cues. This opens the door to future research in the role of olfaction in raccoon social organization.

17: Does size really matter? Influence of avpr1a microsatellite length on reproductive behavior in prairie voles

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Recent studies suggest that single-gene polymorphisms may underlie variation in the expression of
complex behaviors. For example, laboratory studies suggest that male prairie voles (*Microtus ochrogaster*) with longer *avpr1a* microsatellites exhibit behaviors characteristic of social monogamy more frequently than do voles with shorter microsatellites. However, the influence of male *avpr1a* genotype on complex social behavior under natural conditions remains unclear. If *avpr1a* length is positively associated with the expression of behaviors characteristic of social and/or genetic monogamy, free-living males with longer microsatellites should: 1) have smaller home ranges, 2) overlap a greater percentage of their social partner's home range, 3) associate more strongly with a single female, and 4) mate with fewer females than do males with shorter microsatellites. We tested these predictions by quantifying spatial, social, and mating behavior in two prairie vole populations, using a combination of field observations and genetic methods. Contrary to expectations based on laboratory studies, but corroborating previous work in semi-natural enclosures, we found no relationship between *avpr1a* length and any measure of spatial, social, or mating behavior under field conditions. These results suggest that other genetic or environmental factors are more important influences than *avpr1a* length on male behavior in the field.

18: Proximate mechanisms underlying same-sex social behavior in meadow voles (*Microtus pennsylvanicus*)

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Physiological mechanisms underlying social bond formation have been explored in studies of maternal behavior and social monogamy. But non-sexual social bonding remains poorly understood despite its importance for many species. Meadow voles enable the study of non-reproductive social behavior because they are territorial and nest alone in summer, but in winter months they cohabit in groups. In short day lengths when estradiol levels are low, females form enduring and selective pair-bonds with a cohabitating female. Estrogen concentrations are high in females housed in long day lengths when bonds are absent. Treatment with estradiol prevents social bond formation in voles housed in a short photoperiod, but its absence is insufficient to induce social behavior in long-day housed females. In the present studies, behavioral requirements for social bond formation were explored on the basis of sex, cohousing duration, kinship, and group size. I will also discuss two neurobiological correlates of this variation in behavior (oxytocin receptor distribution and estrogen receptor distribution), and the effects of central nervous system infusion of oxytocin. These experiments suggest that non-sexual social behavior is both similar to and different from sexual bond formation in its neuroanatomical substrates.

19: Modeling raccoon recolonization following location depopulation in central Indiana

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Raccoon (*Procyon lotor*) population reduction has been used as a tool for limiting the spread of zoonotic diseases (such as rabies) and alleviating negative effects on threatened wildlife and agricultural crops. However, it is difficult to predict the effectiveness of such control methods without understanding raccoon dispersal. We used SEARCH (an individual based spatially explicit population model) to simulate recolonization of woodlots in the Upper Wabash River Basin (UWB) in north-central Indiana where a large-scale raccoon removal experiment was implemented. Simulation runs consisted of virtual raccoons that were released onto realistic habitat maps of the UWB. Virtual raccoons dispersed through the landscape following species-specific behavioral rules (from empirically derived and published values) and attempted to establish home ranges. Movement rules for the virtual raccoons were varied within
cultivated areas to model raccoon response to various agricultural states present on the landscape. Comparisons of simulated and observed time to recolonization revealed that virtual raccoons parameterized with average values (e.g. movement rate and sinuosity) had recolonization times closest to those observed empirically. Additional simulations of dispersal by best fit virtual raccoons identified the most likely sources of reinvading raccoons and demonstrated that recolonization rates were relatively insensitive to variation in agricultural condition.

**20: Human ecology: Has Homo sapiens exceeded global carrying capacity?**

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Politicians, government officials, and economists suggest that the current "global economic crisis" is just another low in the cyclical pattern of growth and retreat. All that is needed to get "the economy back on track and growing again" is to institute the right recovery policies. But economics depends on human ecology - on the capacity of the earth to supply and the ability of our species to use the resources of energy, water, food, metals, etc. required to support our current industrial/technological society. So, an alternative hypothesis to explain the current "global economic crisis" is that Homo sapiens has exceeded the carrying capacity of the earth and will never return to the level of social and economic development experienced from 1997-2007. We, as scientists, should take this alternative hypothesis seriously and explore its implications. Rigorous quantitative analysis of recent trends in per capita GDP as a function of per capita energy consumption bring into question whether, how, much, and what kinds of further economic development, including will be possible. Society should be debating the possibilities of working toward non-growing, sustainable national and global economies. Ecological expertise should be informing this debate.

**21: Home range and den site selection in the American gog-nosed skunk, Conepatus leuconotus**

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American hog-nosed skunks, *Conepatus leuconotus*, occur throughout much of the southwestern United States, Mexico, and parts of Central America; however, the ecology of this species has received little attention. We are studying den-site selection and home range size of a population of hog-nosed skunks in west-central Texas. To date, we have captured twenty individuals, fifteen of which have been radio-collared and are being monitored. Preliminary analyses of the home-range sizes of individuals located more than ten times (*n* = 10) reveal the average male home-range size is larger than the average female home-range-size (221.32 and 76.01 ha, respectively). Approximately 30% of the den sites we have located (*n* > 150) are associated with large rocks, 30% are burrows, 20% with prickly pear cactus (*Opuntia* spp.), and the remainder with hollow trees, snags or logs, and brushpiles. We have located ten dens that have been used by more than one skunk on different dates and have documented five occasions of cohabitation of a den by two or more skunks.
22: On raptors and rodents: Reconstructing small mammal community dynamics from their skeletal remains

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Natural accumulations of small mammal skeletal remains represent valuable but underutilized sources of historical data that are frequently concentrated by raptor predation. The use of such assemblages first requires an assessment of their fidelity to the modern source prey community. Here I compare data from “modern” death-assemblages concentrated via owl predation with contemporaneous trapping surveys at a long-term cave roost in Nevada to evaluate the effects of time-averaging (over months to centuries) and spatial averaging on the landscape-scale picture of small mammal communities as reconstructed from dead remains. I find high live-dead agreement across numerous ecological community metrics and temporal comparisons, and use a mixing model approach to show that owls sample from all habitats present in the vicinity of the cave. Pellet-derived death assemblages therefore provide high-fidelity snapshots of desert communities that are spatially integrated at the local landscape scale. Finally, using a radiocarbon calibrated time-series, I analyze the deeper strata of the cave to uncover the temporal dynamics of this desert small mammal community over the last 10,000 years.

23: Winter habitat selection by elk in Wyoming with respect to habitat improvement areas

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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, and in turn, increased potential for contact between infectious agents and domestic livestock. Projects are 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 the Buffalo Valley that is primarily free ranging despite proximity of supplemental feed. During the winters of 2006 and 2007, 18 female elk were fitted with GPS collars, which recorded locations every two hours. Habitat characteristics were measured at 48 transects located in habitat treatments of different ages and at random locations. Winter habitat selection was analyzed at two scales, within the study area and within the home range. The two winter field seasons differed in snow conditions, forage availability and the presence of supplemental feed. At the landscape level, thermal conditions were consistently influential, while distance to road and recent fires influenced selection both years, but in opposite ways. Habitat selection within the home range is currently under analysis.

24: Seasonal activity of bats in Palo Duro Canyon (Texas): Mist netting and acoustic monitoring

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Currently there is a lack of basic information for many bats, including abundance, distribution and seasonal occurrence. In July 2006 we began a mist net survey of bats in Palo Duro Canyon State Park, Texas. Since then, we have accumulated 1,265 captures of 12 species in 111 nights (322 net nights) of netting. In June 2008 we began an acoustic monitoring survey of the different habitat types in Palo Duro Canyon. We have recorded over 96,000 AnaBat files and identified 27,007 calls of 10 bat species or species groups from 36 nights of recording (216 detector nights). Mist netting indicates that 5 species
are year-round residents, 5 are seasonal/migratory species, and 2 species are uncommon. Acoustic monitoring added 2 additional uncommon species (*Nyctinomops macrotis* and *Myotis californicus*) and expanded the seasonal occurrence of some species. The highest numbers of bat calls were recorded in riparian areas in every season. Variations in results between methods show value in including both in bat surveys.

**25: What can we learn from bat/aircraft impacts?**

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From 1997 through 2008, 1026 bat strikes were reported to the United States Air Force (USAF) Safety Center by aircraft or ground crew personnel and sent to the National Museum of Natural History, Smithsonian Institution, for identification. Many samples were identified by comparisons with bat specimens housed in the museum augmented during the last three years by DNA analysis. We have received remains from bat strikes from 41 states in the United States and from 22 countries during this period. Forty-two percent of these strikes were confirmed as bats but not identified further; 8% were identified to only family or genus; and 50% were identified to the species level. Twenty-six species of bats have been recorded striking USAF planes world-wide with *Tadarida brasiliensis* and *Lasiurus borealis* being the most commonly identified species. We will review trends seen in species involved, the seasons, times of day, and altitudes of flight, and review some interesting individual cases that document probable altitudinal records for some of the species involved. Goals for improving future bat strike reporting and identification as well as some precautions about interpreting reported data will also be discussed.

**26: Introduction**

Brian M Barnes. Institute of Arctic Biology, University of Alaska Fairbanks

Introduction

**27: Detecting natural selection in Pacific Northwest deer mice: An integrative approach**

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Following the modern evolutionary synthesis, biologists have recognized natural selection as the primary force of evolution in natural populations. However identifying patterns of natural selection in wild populations remains difficult, especially in small mammal species. Thus, to identify the role of natural selection in non-model species, we must use an alternative approach. Pacific Northwest *Peromyscus maniculatus* (deer mice) are morphologically differentiated according to habitat and geography. Using nuclear microsatellite data, we show that morphologically differentiated populations are indistinguishable at neutral loci and that strong gene flow exists between these populations. Next, we compare the morphological and neutral genetic patterns of these populations using multivariate statistical approaches and identify the specific traits most differentiated between populations. The maintenance of differentiation in these traits in the face of strong gene flow indicates the role of natural selection on these populations. Finally, we present natural-history based hypotheses on why these traits are under selection.
28: Estrogen, ion channels, and thermoregulation: From hot flashes to hibernation

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Control of body temperature ($T_b$) is characteristic of mammals; however, the setpoint about which $T_b$ is regulated can change daily, seasonally, or over the lifespan. The neural networks responsible for thermoregulation are composed of an intricate web of spontaneously firing temperature sensitive and temperature insensitive neurons and "silent" neurons. Electrophysiological models predict that neurons can be converted from spontaneously active neurons to silent neurons by changing the levels of various ion channels (e.g., the potassium channel TREK-1). We hypothesize that estrogen (E) regulates expression of these channels; staining for both estrogen receptor alpha (ERalpha) and TREK-1 were observed on the same cells. OVX mice have increased peripheral heat loss, as measured by tail skin temperature, and increased variability in TST, as compared to OVX+E mice. Infusion of linolenic acid, an agonist of TREK-1 in vitro, into the lateral ventricles of the brain reduced TST and stabilized variability of TST in OVX mice; responses in OVX+E mice indicated the effect was not a nonspecific hypothermic response. These results suggest that estrogen regulates peripheral heat loss, in part, through the regulation of neuronal ion channels; these changes in temperature dependent ion channels may alter the regulatory dynamics of thermoregulatory neural networks.

29: Ecological and evolutionary forays with charismatic microvertebrates and El Jefe

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Big ecological and evolutionary questions, when posed in nature, require large amounts of sampling and data. It is perhaps for this reason that small mammals have traditionally played a large role in such research. As the ease and availability of genetic tools rapidly increased in the late 1990s, so did our ability to examine these classic and well studied species through the application of a suite of genetic and traditional approaches. In particular, work in the Kenagy lab at this time contributed substantially to our understanding of the influence geological history on the small mammal fauna in western North America. Further, we strove to maintain the focus on ecology and natural history and in so doing were able to develop novel approaches for understanding how ecological level processes shape patterns of genetic variation.

30: Comparative phylogeography of southern South America: Exploring patterns across taxa to understand regional evolutionary history

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Comparative phylogeography is a powerful approach that facilitates robust testing of hypotheses on the evolutionary history of ecological communities. South America has a rich climatic and geological history which has impacted intraspecific diversity and geographic distribution of lineages. Features of the geographic landscape facilitate the development of hypotheses regarding the evolutionary trajectories of taxa. For example, phylogeographic breaks are anticipated to be associated with the Andes Cordillera that runs north-south and additionally with major drainages that run east-west. Comparison across multiple taxa is anticipated to reveal the influence of each geographic barrier on the contemporary ecological community. I am conducting a meta-analysis on species inhabiting southern South America using available molecular datasets. Specifically, I am interested in 1) identifying concordant interspecific patterns, 2) distribution of genetic variation, and 3) patterns of historic migration. Further, I will explore commonly used qualitative comparative approaches and explicit tests.
on the spatial arrangement of genetic variation. Southern South America has a complex geologic, climatic, and biogeographic history as revealed by numerous independent analyses. I anticipate that this study will contribute to the understanding of the regional historical biogeography and to the broader application of comparative approaches in phylogeographic analyses.

31: Hibernation and the Ark

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An article published at www.creationontheweb.org discusses the implications of yearlong hibernation by eastern pygmy-possums (*Cercartetus nanus*) for the "Flood Account" and prolonged survival of animals on Noah's Ark. The article correctly points out that prolonged periods of daily torpor and hibernation (multi-day torpor) enable mammals to survive adverse conditions on limited food. As torpor substantially reduces food and thus foraging requirements the question arises whether torpor could have implications for mammalian conservation. This is especially important because recent evidence shows that torpor is much more widespread than previously thought, occurring in mammalian orders that contain >2/3 of all extant mammals from all climate zones. Interestingly, of the 61 mammals confirmed extinct over the last 500 years, 57 were likely homeothermic (unable to enter torpor) whereas only 4 species were likely heterothermic (capable of torpor). This suggests that torpor use permits mammals to survive not only adverse conditions, but also helps them in dealing with habitat degradation and introduced competitors/predators. Thus, while the significance of torpor use on the Ark may never be resolved, it appears that torpor use in extant mammals is an important factor that has been overlooked but must be considered by conservation biologists.

32: Hybridization in a pine squirrel (*Tamiasciurus*) contact zone in the Pacific Northwest

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Population genetic analyses of hybrid zones can serve as important starting points for investigating evolutionary mechanisms responsible for differentiating closely related species. Phylogeographic studies of North American forest mammals have shown that several secondary contact zones between previously isolated genetic groups are clustered in the Pacific Northwest. The extent to which reproductive isolation has evolved within many of these species has not been well investigated. We use a multilocus approach to examine the history of hybridization and gene flow between two sister species of pine squirrels (*Tamiasciurus douglasii* and *hudsonicus*) in a contact zone in the Pacific Northwest. These mostly allopatric species meet in a narrow zone of contact in the north Cascade Mountains of Washington and British Columbia. Our results indicate that introgressive hybridization of mtDNA has occurred in each species. In addition, our analyses of differentiation based on 9 microsatellite data suggest that admixture of nuclear genetic diversity is prevalent in the hybrid zone. These findings reveal that reproductive isolation is not complete between these species.

33: Contrasting roles of endogenous and exogenous control of seasonal reproductive rhythms in hibernating sciurid and heteromyid rodents

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We present a contrast here between the seasonal reproductive rhythms of two kinds of hibernating rodents. Pocket mice (Heteromyidae) of the species *Perognathus parvus* show gonadal development in
response to seasonal increases in photoperiod, and this response is based on an endogenous circadian rhythm of photosensitivity. Arctic ground squirrels (Sciuridae) of the species *Spermophilus parryii* show spontaneous gonadal maturation that is expressed in continuous darkness, i.e., in the absence of daily and seasonal variation in light-dark cycles and without the apparent involvement of an active circadian system. Both species breed following emergence from hibernation in the field, but gonads of pocket mice require stimulation by long photoperiods for full development. Pocket mice are also capable of a flexible reproductive response and can prolong breeding under favorable environmental conditions, whereas arctic ground squirrels follow a programmed and relatively inflexible cycle of gonadal recrudescence and regression. Both strategies of physiological control of reproduction allow successful responses to current environmental seasonality, but the ability of these two different species to respond to rapid changes in climate may differ due to the different degrees of endogeneity and flexibility underlying their systems of reproductive control.

34: The effect of white-nose syndrome on torpid metabolic rates of *Myotis lucifugus*

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White-Nose Syndrome (WNS) is a large-scale epidemic that is killing cave-dwelling bats in the northeastern United States during the winter by causing bats to deplete all of their fat reserves before hibernation is over. We hypothesized that little brown bats (*M. lucifugus*) with WNS have elevated metabolic rates while torpid. We measured in situ oxygen consumption rates and body temperatures (with iBBat temperature-sensitive dataloggers) throughout the hibernation season at a Williams Lake mine (WNS-affected area in NY), at Woodward Cave (very recent WNS-affected area in PA), and at Brooks Cave on Ft. Leonard Wood military base (unaffected area in MO). Most bats showed normal torpor metabolism (n = 7 to 27 per site and month), but the metabolic rates of bats in NY were two to three times higher that of bats in PA, both in early hibernation (October) and mid-hibernation (January) (P = 0.001). Torpid metabolic rates of bats in PA were similar to rates measured in other bat species in our lab. This is consistent with our hypothesis, even though Woodward Cave became affected this March. Bats in MO had intermediate rates of metabolism, possibly due to geographic differences.

35: Hibernation arousal patterns in little brown myotis (*Myotis lucifugus*) affected by white-nose syndrome (WNS)

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White-nose syndrome (WNS), a mysterious condition first described in 2007, has killed an estimated half million+ cave-dwelling bats in the northeastern US and is rapidly spreading west and south. WNS is characterized by: (1) the presence of a cold-loving fungus on the muzzle and/or wing membranes; (2) aberrant behavior (hibernating near the entrance of caves/mines and/or midwinter emergence from hibernacula); and (3) poor body condition (damage to wings and loss of body weight). To test the hypothesis that WNS affected bats either arouse from torpor too frequently during hibernation or remain euthermic for longer periods than normal, resulting in the depletion of body fat stores and eventual death, 221 temperature sensitive dataloggers and 185 radiofrequency transmitters were attached to WNS

affected and unaffected bats at 13 hibernacula in 6 states. While large site-to-site variation in hibernation patterns was evident, likely due to variations in ambient temperature and initial body condition, preliminary evidence strongly suggests that WNS affected bats arouse more frequently than unaffected bats, but that, with a few exceptions, WNS bats are not remaining euthermic for prolonged periods. Additionally, dataloggers attached to WNS bats showed that nearly all died abruptly at the end of an arousal bout.

36: Factors affecting Indiana bat detection probabilities with acoustic detectors
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Inventory and monitoring programs are critical for assessing population status of endangered species and effects of conservation measures on their populations. However, because detection probabilities are <1 for most species, probability of detection should be considered when designing surveys. The objective of this study was to determine the effects of 2 factors (sampling length and habitat type) on Indiana bat detection probabilities using acoustic detectors. Thirty sites were sampled for 3 nights in late June and mid-late July 2008 at 2 locations where Indiana bat maternity colonies were documented in 2007. Four habitat types were sampled: linear/non-water sites (e.g., corridors, edges), linear/water sites (e.g., streams), non-linear/non-water sites (e.g., open fields), and non-linear/water sites (e.g., ponds). We identified calls to species using a discriminant function analysis and determined the probability of detecting Indiana bats using program PRESENCE. Detection probabilities did not vary with sampling night but were lower for ½-night sampling (0.43-0.47) compared to full night sampling (0.52-0.59). Detection probabilities were highest over streams (0.70-0.88) followed by linear corridors (0.52-0.59). Thus, probability of detecting Indiana bats can be maximized if detectors are placed in linear corridors with or without water, and sampling is conducted for the entire night.

37: Wind development and major bat roosts in the Texas Panhandle
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Texas currently leads the nation in electricity generated from wind. Much of the panhandle of Texas contains class 4 winds and development of new wind farms has increased greatly in recent years. Class 4 winds, lack of state regulation, and other programs will encourage continued rapid development of wind energy in the panhandle causing concern for its potential impact on bats. Unfortunately, information on bat resources in the panhandle is lacking. Without solid data on colony size, composition, and temporal variation in colony size we will be unable to evaluate the impacts of large-scale wind-energy development in the region on bats. We have intensively monitored a colony of free-tailed bats for >2 years and have located others by use of Nexrad weather radar and ground surveys. All of the large colonies we have discovered are located along the escarpment of the Llano Estacado, a location favored for wind development because of the additional wind speed associated with a change in elevation. We will continue to locate, survey, and monitor colonies to bring their locations to the attention of developers and to assess the impacts of wind development on the colonies.
38: Isolation by distance measured by average relatedness in populations of ringed seals (Pusa hispida)

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To determine the impact of isolation by distance, the average relatedness was estimated for populations of ringed seals (Pusa hispida) sampled along the North Slope of Alaska, western Canada, and Finland. Tissue samples were collected from skin, hair, and small flipper clippings. DNA was extracted and amplified at 7 microsatellite loci using PCR, and visualized using the Applied Biosystems 310 Automated DNA sequencer. The program Relatedness was used to determine the amount of relatedness by distance. Relatedness was calculated for all pair-wise comparisons of individuals within each area and for all pair-wise comparisons between individuals for all population pairs. Relatedness values were compared to distance values in 200km increments. Individuals within a sample site (average r = 0.024 ± 0.013 SD) were significantly more related (Un1=52, n2=11 = 569, p <

39: Reproducing demographic measures from lethal collections without lethal collections: Monitoring fur seal reproduction with ultrasonography

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From peak pup production of over 550,000 in the 1950's, Pribilof Island rookeries now produce fewer than 130,000 pups. Fur seal numbers declined in the 1960's from intentional over-harvest, but an irregular post-harvest decline beginning in the mid-1970's has recently accelerated to ~6% annually. In order to compare contemporary rates of pregnancy with those estimated in the 1960's from lethal collections, we employed ultrasonic imaging to diagnose pregnancy rates and other features of early pregnancy in 156 parous females at the end of reproductive diapause in November 2005, 2007 and 2008. Embryonic vesicles as small as 2 mm were detected by ultrasonography, but using a minimum size criterion of 5 mm produced a detection rate by date relationship that was more comparable to necropsy data. Measurements of the outside diameter of the uterus in ultrasound images also supported the use of a minimum size criterion to filter contemporary data and make valid comparisons with rates obtained earlier by gross necropsy. Statistical modeling and longitudinal follow-up of contemporary pupping rates supported the conclusion that contemporary pregnancy rates were high and comparable to historic estimates made prior to the post-harvest decline in fur seal numbers.

40: Muskox genetics: DNA from ancient permafrost bones to the present

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The muskox (Ovibos moschatus) is one of the few Pleistocene megafauna species in Beringia still living there today. Generations of muskoxen left behind bones which were incorporated in the permafrost after the animals died. In this study, we extracted DNA from old and modern muskoxen to investigate genetic change from the late Pleistocene to the present. Understanding the timing of development of low genetic diversity in muskoxen will be helpful in predicting the significance of diversity in other
species as they encounter climate change. We collected muskox bones from river drainages in northwest Alaska. The skulls of muskox males as well as muskox metatarsal and metacarpal bones are among the most common bones found along the rivers surveyed. We obtained C\textsuperscript{14}AMS dates on 62 of these bones which range from infinite dates (past the upper limit of C\textsuperscript{14} dating ~ 40,000 years BP) to 226 years BP. We generated 634 base pairs of sequence data from the mitochondrial DNA control region for > 40 muskoxen. Genetic variation among the samples is limited. Bayesian analysis of the sequences suggests a temporal pattern of genetic change that may be the result of population turnover events related to periods of environmental change.

41: Landscape genetic analysis of population structure in the Texas gray fox (Urocyon cinereoargenteus) oral rabies vaccination zone

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In west-central Texas, USA, abatement efforts for the gray fox (Urocyon cinereoargenteus) rabies epizootic illustrate the difficulties inherent in large-scale management of wildlife disease. The rabies epizootic has been managed through a cooperative oral rabies vaccination program (ORV) since 1996. Millions of edible baits containing a rabies vaccine have been distributed annually in a 16-24 km zone around the perimeter of the epizootic, which encompasses a geographic area > 4 \times 10^5 km\textsuperscript{2}. The ORV program successfully halted expansion of the epizootic into metropolitan areas, but has not achieved the ultimate goal of eradication. We employed a landscape-genetic approach to assess gray fox population structure and dispersal in the affected area, with the aim of assisting rabies management efforts. No unique genetic clusters or population boundaries were detected. Instead, foxes were weakly structured over the entire region in an isolation by distance pattern. Local subpopulations appear to be genetically non-independent over distances exceeding 30 km, implying that long-distance movements or dispersal may be common in the region. We conclude that gray foxes in west-central Texas have a high potential for long-distance rabies virus trafficking. Thus, a 16-24 km ORV zone may be too narrow to contain the fox rabies epizootic.

42: Recolonization or local reproduction? River otter recovery in previously-oiled areas of coastal Alaska

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River otters (Lontra canadensis) were one of the first resources to recover from the 1989 Exxon Valdez oil spill (EVOS) in Prince William Sound (PWS). Nonetheless, genetic evidence suggests that the numerical recovery of otters in oiled sites resulted from recolonization from adjacent areas rather than
from local reproduction. Because increased trapping pressure on otters in recent years occurs mainly in non-oiled areas of PWS, previously-oiled sites may become important source locations for these animals. We determined whether reproduction was recovered in otter populations inhabiting previously-oiled areas of PWS and Kenai Fjords, using genetic tools and non-invasive fecal sampling. We genotyped 594 fecal samples at 8 hypervariable microsatellite DNA loci. These samples represent 319 individuals from 7 genetically distinct populations. Our results suggest that relatedness among individuals in previously-oiled bays were still lower compared with lightly-oiled and non-oiled bays. Similarly, $F_{IS}$ values suggested that otters in highly-oiled bays are slightly more outbred than those from lightly and non-oiled areas. Thus, we conclude that otter reproduction has not fully recovered from the effects of EVOS and only lightly-oiled areas could serve as sources for sustainable otter harvest in PWS.

43: Genetic diversity and bottleneck analyses in Anacapa deer mice

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In 2002 Channel Island National Park began a program to eradicate nonnative black rats from Anacapa Island The program included a plan to capture and reintroduce endemic deer mice, *Peromyscus maniculatus anacapae*, on all three islets. Prior to rat eradication, mice were trapped from Anacapa, held in captivity and later used as source populations for reintroductions. Our objective was to monitor their demographic and genetic recovery. To accomplish this, all founders were sampled, and then mice were trapped, sampled, and released during the post-reintroduction period (2002-2005). We used ten microsatellite loci to compare the genetic variability levels and effective population sizes ($N_e$) before and after the reintroduction. The gene diversity, which was fairly high among the founders, remained at similar levels during the recovery. The exception is East Anacapa populations where the heterozygosity levels and allelic diversity increased as a result of mixing founders from all three islets. The ratio of estimated effective population size to census population size in temporally isolated populations showed an increase in $N_e$, indicating no bottlenecks related to management has happened. Overall our results show that the reintroduction plan has been successful in terms of reestablishing genetically diverse Anacapa Island deer mice.

44: Genetic impact of fragmentation on badgers (*Taxidea taxus*) in Michigan: The role of niche breadth

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Carnivore response to habitat fragmentation varies due to many factors. One suggestion is habitat specialists are more vulnerable to the negative consequences of fragmentation such as increased isolation between populations. In Michigan, previous genetic studies have indicated that generalist bobcats (*Lynx rufus*) are not isolated by anthropogenic sources. Unlike bobcats, American badgers are more specialized, so badgers may exhibit more population substructuring in Michigan. To test this hypothesis, we genotyped 152 badgers from the Lower Peninsula of Michigan at seven microsatellite loci. No substructuring was detected at the landscape level via the Bayesian program BAPS or at finer scales using relatedness coefficients. Therefore, despite their differing niche breadths, both bobcats and badgers form panmictic populations within the Lower Peninsula of Michigan.
45: Investigating the patterns and processes of speciation: An example using phylogenetics and niche modeling with the *Peromyscus maniculatus* group

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Phylogenetics has greatly improved our ability to understand patterns of speciation; however, with recent advances in the area of ecological niche modeling we can test the role of environment on speciation. Adaptation to unique environmental spaces contributes to the isolation of unique genetic lineages and maintains distinct evolutionary trajectories. Using the widely distributed deer mouse (*Peromyscus maniculatus*) and members of the maniculatus species group, we estimated the phylogenetic patterns within the species group. Bayesian inference and maximum likelihood were used to estimate the evolutionary history of the group from complete cytochrome *b* sequences. Based on the genetic lineages we used niche based modeling with 20 environmental variables (altitude + bioclim) to determine if they occupied unique ecological spaces. Principle component analysis was utilized to determine niche space for each lineage. Spatial niche distributions were predicted using maximum entropy, and potential contact zones between lineages were determined.

46: Introduction to the symposium: Diverse perspectives on home ranges of mammals

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47: Home range viewed through the eyes of a statistical consultant

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Statisticians frequently voice concern that their interactions with applied researchers start only after data have been collected. The same can be said for our experience with telemetry studies. Too often, conversations about "home range" begin with questions concerning estimation methods, smoothing parameters, or the nature of autocorrelation. More productive efforts start by asking good (and interesting) research questions; once defined, it becomes possible to ask how various design and analysis strategies influence one's ability to address these questions. With this process in mind, we briefly review popular, as well as some newly developed, statistical home range estimators, focusing on their biological assumptions and some of their statistical properties. Although the choice of estimator should depend on study objectives, we suggest comparative studies would benefit from more standardized sampling regimes and estimation methods. More attention should also be given to temporally changing space use patterns, with biologically meaningful time periods (e.g., life history stages) used to define sampling periods. Lastly, we argue the need for more focused research studies and closer connections between theoretical and empirical researchers. Advances in ecological theory, and application, will require carefully designed research studies to test theoretical predictions from more mechanistic modeling approaches.

48: Mechanistic home range models: An emerging framework for understanding and predicting patterns of animal space use

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Patterns of space-use by individuals are fundamental to the ecology of animal populations influencing
their social organization, mating systems, demography, and the spatial distribution of prey and competitors. To date, the principal method used to analyze the underlying determinants of animal home range patterns has been resource selection analysis (RSA), which examines the relative frequencies of animal relocations in relation to landscape attributes. Here, using patterns of movement and space-use by coyotes (Canis latrans) and elk (Cervus elaphus) in Yellowstone as examples, I discuss how mechanistic home range models provide a new alterative theoretical framework for understanding how an animal's behavioral responses to resources, conspecifics, competitors and predators gives rise to its observed pattern and intensity of space use.

49: Home ranges and the value of spatial information

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Animals concentrate their activities within areas we call home ranges, because knowing about places increases fitness. I define the value of information as a probabilistic and dynamic function of resource distributions in space and time, and integrate it into models that predict movements of animals that learn, forget, and use information. Unlike other space-use models, these recognize that movement decisions are based on imperfect and ever-changing expectancies about the environment-rather than omniscience or ignorance. I demonstrate how the optimal use of such information, assuming different spatio-temporal resource distributions and patterns of predictability, predicts a broad range of space-use phenomena, from momentary movement decisions and movement paths to home-range utilization and population spacing patterns. This dynamic information theory explains diverse movement patterns documented in mammals, including systematic patrolling or "trap-lining," shifting activity or focal areas, extra-home range exploration, and seemingly random (though directed and spatially contagious) movements. It also predicts inter-individual spacing patterns, from exclusive home ranges (whether defended or not) to broadly overlapping or shared ranges. The fitness value of cognitive maps and the selective exploitation of spatial information support a general theory of animal space use, which explains why mammals have home ranges and how they use them.

50: Game theoretic home ranges

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Imagine foragers moving nomadically and randomly throughout their entire landscape. If the foragers instead subdivide this landscape into equally-sized, exclusive territories, two advantages accrue: 1) improved knowledge of a smaller area, and 2) the opportunity to move systematically through an area they "own". As a behavioral game however, the exclusive territory may not be evolutionarily stable (ESS). It may be subject to invasion by "cheaters" who enjoy their own territories while not respecting a neighbor's. Factors determining whether one or both are ESS include costs and benefits of antagonistic behavior, the ability to crop resources sufficiently to discourage intruders, the intruders "destruction" of useful information, and the opportunities for using repeated plays of the game to condition "neighborly" behaviors. These costs and benefits can switch the nature of home ranges from shared to relatively exclusive. Finally, imagine that the food items themselves are behaviorally responsive animals (e.g. mountain lions seeking mule deer and snow leopards seeking Himalayan tahr- two favorites of mine). An exclusive territory allows the predator to manage the fear level of its prey. The vulnerability of prey may be as important as the density of prey. These models of home-range include predator-prey foraging games as well.
51: The synthetic home range

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Home ranges present 2 inter-dependent problems: describing them and understanding them. Describing home ranges depends explicitly on data available and implicitly on what we understand home ranges to be. Understanding home ranges requires insight into what is important to animals and how they make decisions. The approaches presented in this symposium contribute to resolving both problems. Movements of animals depend ultimately on decisions about home range placement, a function of how animals forage for home ranges based on the distribution and availability of resources, and depend proximately on information about resource productivity, recent movements, and how these are influenced by competitors and predators. Researchers use information on movements to estimate utility distributions, which when plotted in various currencies (time, energy, fitness) can provide insights into the mechanisms by which animals choose and use their home ranges. The link between describing and understanding home ranges is the fitness relationship between an animal and its surroundings, represented by its home range. Recent research relating vital rates to resources within home ranges addresses this linkage explicitly, tying use of variable, resources (amidst competitors and predators) to fitness consequences of home range behavior and begins to answer the question: What is a Home Range?

52: Impact of recent environmental change on Great Basin small mammals: An 80-year resurvey of the Ruby Mountains, Nevada

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Biotic communities in the Great Basin are changing dramatically due to shifting land use, invading alien plants, and global warming. Our study uses comparative resurveys across an 80-year interval to measure changes in the small mammal fauna of the Ruby Mountains. We used historical records (specimens, field notes, and photographs) from a survey conducted by Adrey Borell (1927-1929) to reconstruct species assemblages and ecological conditions at 9 localities. During 2006-2008, we made new field surveys to assess changes in community composition and shifts in the distributional ranges of species along the elevation gradient. At local sites there have been significant changes in relative abundance or occurrence, some in conjunction with major floristic changes, and others apparently in direct response to climate warming. At the landscape scale (along the elevation gradient), there were changes in the proportional abundance of mesic and xeric-adapted species, and upslope range shifts of a few mesic-adapted species consistent with predicted responses to climate warming. However, we did not observe upslope range shifts or expansions for any xeric-adapted species. This is inconsistent with a climate-based hypothesis and may reflect the unexpected predominance of habitat changes driven by land use at this broad spatial scale.

53: Shifts in the distribution of muskoxen in northeastern Alaska

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We studied a reestablished population of muskoxen (Ovibos moschatus) in and near the Arctic National Wildlife Refuge (Arctic Refuge) in northern Alaska to monitor changes in the abundance and distribution of the population. We radio-tracked collared muskoxen and flew annual pre-calving
censuses in 1982-2009 in the Arctic Refuge and in 1986-2006 west of the refuge. We compared these data to locations of muskoxen observed in the Arctic Refuge from 1972-1976, a few years after their release. We used Geographic Information System (GIS) analyses and spatial statistics to detect patterns of population distribution and changes in local abundance. By 1987, mixed sex groups of muskoxen expanded their range into new areas east and west of the Arctic Refuge. By 2002, muskoxen had disappeared from areas in the refuge that they had occupied for several years. We counted fewer than 10 muskoxen in the Arctic Refuge in 2005-2007 when about 200 individuals were living west of the refuge and about 50-100 muskoxen were in northwestern Canada. A few groups containing radiocollared females returned to the refuge in 2007-2008 and one of these groups was still present in 2009.

54: What's killing North America's mammals? A meta-analysis of cause specific mortality

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Every organism dies eventually. The cause of these deaths is a measure of the evolutionary pressures faced by a population that can be compared between species. These forces can be quantified by remotely monitoring individuals to detect their demise and conducting post-mortem examinations to determine the cause of death. Although such studies have been conducted for many species, there has been no attempt to examine trends across species for any taxonomic group. Here we review 2263 total mortality events from 87 North American mammal populations across 29 species. Humans are the main cause of mortality (43.8%), followed by natural (40.9%) and unknown causes (15.3%). Predation (29.6%) was most prevalent in smaller species, especially herbivores. Human causes were higher for legally unprotected populations, especially carnivores and larger species. Road kill (7.9%) was correlated with the level of human development in the local landscape. Hunting (25.1%) was the most important source of human-caused mortality followed by roadkill (7.9%). However, even populations protected from hunting have high levels of human-caused mortality (28.4%). These results show that humans are now the dominant selective force on mammals in North America, predicting that individuals that survive these pressures may evolve to minimize these mortality causes.

55: Developing a habitat model for Franklin's ground squirrel using occupancy modeling

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Documented population declines of Spermophilus franklinii (Franklin's ground squirrel) in the Midwestern U.S. have made the species a recent focus of conservation concern and emphasize the need for information on its habitat requirements. We are developing a habitat model for S. franklinii using occupancy modeling to evaluate the relative importance of local site quality and landscape context as constraints to the species' distribution. We collected presence-absence data on S. franklinii during the summers of 2007 and 2008 at locations in Illinois, Indiana, Iowa, Missouri, and Wisconsin. At each location, we livetrapped S. franklinii for 4 consecutive days at ~7 sites within a 5-km radius (expected dispersal distance) of a site where S. franklinii was historically present. We captured S. franklinii on 21 of 62 sites in 2007 and 17 of 62 sites in 2008. Occupancy models indicated S. franklinii occupied 34% of sites within 5 km of historically occupied sites. Additionally, use of 4-day trapping sessions demonstrated detection rates of S. franklinii (0.595) are not as high as previously suspected using 2-day
trapping sessions. Preliminary results suggest *S. franklinii* is as likely to be present in roadside habitat consisting of undisturbed non-native grasses as in native prairie habitat.

56: Urban landscape features influencing rodent control and animal movement in two urban areas of California

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"Pest" control of both native (e.g., gophers) and exotic (e.g., black rats, house mice) species may impact populations of non-target species inadvertently. We evaluated relationships between animal movement, rodent control, and landscape features in two urban locations in California. Southwestern Bakersfield consists of high- and medium-density development and is home to an urban population of San Joaquin kit foxes. Southeastern Ventura County contains low-and medium-density development interspersed with natural areas and is home to several large carnivores. We collected rodent control data via a resident survey and compared results to animal movement data from radio-tracking studies. In Bakersfield, kit foxes used altered open areas (sumps, golf courses, schoolyards) for denning and foraging, commercial areas for foraging, and occasionally used residential areas. Rodent control did not vary with development density. In Ventura County, bobcats, coyotes, and mountain lions used natural areas most intensively; bobcats and coyotes used altered open and low-density residential areas extensively and high-density residential and commercial areas occasionally. Rodent control was widespread, but more likely in low-density developments and near natural areas. Areas of overlap between wildlife use and rodent control increases potential for adverse impacts to wildlife and may be important target locations for mitigation measures.

57: Diet and food availability of the endemic Prince of Wales flying squirrel: Implications for dispersal

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In a fragmented landscape, individuals dispersing between habitat patches support functioning metapopulations and allow for recolonization of patches following localized extinction. Where dispersal is energetically expensive, the ability to replenish diminished energy stores may influence dispersal success. Thus, availability of potential food items in the managed matrix could influence dispersal success (and ultimately metapopulation viability) in fragmented landscapes. The endemic Prince of Wales flying squirrel (*Glaucomys sabrinus griseifrons*) inhabits an area altered significantly by broad-scale timber harvest and management. In this study, we estimated the diet of northern flying squirrels using stable isotope and fecal analyses, determined whether food availability varies between old-growth and managed stands, and assessed the likelihood of successful dispersal across a managed landscape given food distribution. Both stable isotope and fecal analyses revealed that conifer seeds, lichen, and fungi were the main dietary items consumed and assimilated. Our surveys showed that old-growth habitats had significantly more conifer seeds, truffles, and lichen, than second-growth and
clearcut habitat. Thus, our results indicate that diet and availability of diet items on Prince of Wales Island, Alaska likely reduces dispersal success of northern flying squirrels across fragmented landscapes because of limited or unavailable food resources in the managed habitats.

58: A tale of two males in the Arctic: Contrasting strategies for rut in reindeer and muskoxen

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Arctic ungulates are constrained by a highly seasonal environment; males must grow and gain body stores for the mating season (rut) over a short summer and potentially lose those stores in rut before the start of winter. We compared intact (bulls) and castrated male reindeer (*Rangifer tarandus*) and muskoxen (*Ovibos moschatus*) in captivity where food and water were provided *ad libitum*. Bulls of both species were characteristically aggressive towards animate and many inanimate objects throughout rut. Reindeer bulls lost 34% of body mass during rut but did not regain body mass until the following spring. Muskox bulls maintained body mass over the period of rut as did castrated reindeer and muskoxen. Rumen digesta and tissue mass were reduced during rut in reindeer bulls but maintained in muskox bulls and castrates of both species. Plasma cortisol increases during rut in reindeer bulls (8.5 µg/dL) whereas cortisol concentrations are low in bulls and castrates among muskoxen (1.5 µg/dL). Reindeer bulls compete continuously to establish dominance during rut but dominance hierarchies established before rut among muskoxen may allow bulls to reduce stress, continue feeding and conserve body condition for survival in the subsequent winter.

59: Growth of male white-tailed deer: Consequences of maternal effects

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We quantified growth and development of male white-tailed deer (*Odocoileus virginianus*) originating from the Black Hills, and from eastern South Dakota, in a controlled environment with high-quality nutrition. Despite being in good nutritional condition, males from the Black Hills ceased rapid growth 41 days earlier, were 29% smaller at asymptotic body mass, and grew significantly smaller antlers than males from eastern South Dakota. Females from eastern South Dakota were 14.9 kg larger than females from the Black Hills. Male offspring of 1ˢᵗ-generation deer from the Black Hills attained a 30% larger asymptotic body mass and grew significantly larger antlers than their sires. Body mass and antler size of 2ⁿᵈ-generation males of Black Hills origin approached that of 1ˢᵗ-generation males from eastern South Dakota at maturity. Suppression in growth of 1ˢᵗ-generation males of the Black Hills and increased growth by their offspring supported an influence of maternal and grandmaternal condition during gestation on subsequent growth of offspring and highlighted the significance of nutrition during gestation. These intergenerational effects indicate that measures of animal condition and population performance might reflect past rather than current conditions, and illustrate the potential for time lags in responses of populations to improved environmental conditions.
60: Fecal nitrogen as an index to diet quality: Sex-specific effects
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Concentration of fecal Nitrogen (FN) has been used widely as an indicator of forage quality for free-ranging ruminants; however, potential weaknesses in this index exist. Our objective was to evaluate the influence of sex on FN concentration. Four male, four non-reproductive female, and four reproductive female white-tailed deer were fed an ad libitum diet of corn and pelleted soyhulls and a restricted diet where corn was offered at 40% of ad libitum intake. We collected feces twice daily from 14 May through 18 August 2008. We combined weekly samples per individual and dried, ground, and processed them using Micro Keldahl procedures. In general, FN reflected diet quality because deer on the restricted diet had lower FN compared with the ad libitum diet. During gestation mean FN of reproductive females was similar to that of males and non-reproductive females on similar diets. During lactation, however, FN of reproductive females in both diet groups was lower (P < 0.05) and remained lower throughout lactation. We hypothesize that intestinal tissues of lactating females are more efficient at extracting nitrogen than those of non-reproductive females or males. This increased efficiency provides nutrients for body maintenance and milk production.

61: Effect of maternal body condition and nutrient intake on milk intake of caribou and reindeer
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Frequently, reindeer and caribou are born onto emergent vegetation that is rich in protein. But otherwise calves are born onto areas of complete snow cover. We estimated milk intake by isotope dilution. Maternal body protein (BP) was estimated from water distribution, and body fat (BF) was assumed to be ingesta-free body weight minus body protein. Metabolizable energy (ME) and digestible protein (DP) intakes were estimated from isotope turnover assuming relations in the NRC. Low birth weight reindeer calves that made compensatory weight gain correlated with an increase in milk intake. Thus low maternal BF in their dams was a consequence of compensatory calf growth. Maintenance ME and DP requirements were higher in lactating caribou than reindeer. At zero maternal balance, milk synthesis requirement for net energy (NE) was less in caribou than reindeer, but net protein output was greater for caribou than reindeer. Thus for caribou, the putative lower milk NE output in relation to maintenance ME requirement ensures a lower ME requirement for zero maternal protein balance. This is an advantage to animals calving onto “greening” range. In contrast, for reindeer, the lower absolute ME and DP requirements for lactation would be adaptive to economical use of body reserves.

62: Dynamics of body reserves in captive muskoxen (Ovibos moschatus) during winter
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The role of energy in limiting reproduction in muskoxen is well documented, but we know little on the role of body protein in the production of offspring. We studied 14 female muskoxen (n = 9 not pregnant; n = 5, pregnant) in February-June 2007 to assess changes in body composition and isotopic correlates of body condition (p-UN) and diet in urine, blood, and feces. We measured body masses and collected biological samples every 4 weeks between 7 February and 5 April, then 5 days after calving (postcalving). We measured components of body reserves (i.e., total body fat, subcutaneous fat, and lean mass) through dilution of body water space and ultrasonography. The proportion of urea N derived from body N (p-UN) was estimated from the isotopic ratio of N in the diet, urinary urea, and red blood cells. All muskoxen lost body mass (-6 to -12%) and fat (-22 to -24%) over the winter while pregnant muskoxen catabolized lean mass (-6%) in late gestation; non-pregnant animals tended to replenish stores of body protein (+6%) in late winter. Reproduction in muskoxen may be constrained by the availability of body N during gestation and early lactation.

63: You are what you eat: The key role of mesquite in promoting survival in an extreme environment

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Death Valley, California, is one of the hottest, driest places in the western hemisphere. Summer temperatures are regularly over 50°C, and rainfall averages less than 5cm a year. This extreme environment is home to a thriving population of Desert Woodrats (Neotoma lepida). Unlike other populations of N. lepida, this population is completely dependent on a single species of plant, mesquite (Prosopis glandulosa), for survival. Mesquite is the sole source of thermal protection, protection from predators, water, and food. Members of the Smith lab have trapped woodrats in Death Valley since 2004 and found significant differences in survivorship and potentially reproduction across our study site. Here, I analyze several characteristics of the mesquite plants that might contribute to differences in observed fitness: spinescence, overall size, palatability, water content, and toxin content. My results indicate no relationship between overall size, palatability (as measured by % nitrogen), and survivorship. Interestingly, spine density was positively correlated with persistence, suggesting that spinier mesquite plants are able to better protect rats from predators. This research contributes to our understanding of the ecology of N.lepida living in an extreme environment, as well as our general understanding of how organisms adapt and interact in extreme environments.

64: Foraging rates of wapiti on alfalfa/bromegrass pastures

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Within Aspen-boreal ecosystems, little information exists on functional response of wapiti foraging on improved pastures. We compared feeding rates (g/min) of wapiti (Cervus elaphus nelsoni) on predominantly bromegrass (Bromus riparius Rhem. cv. Regar) and pure alfalfa (Medicago sativa L.) pastures as they were progressively defoliated. In grass-dominated stands, estimated dry matter (DM) and energy intake rates of wapiti were asymptotically related to available herbage, and superior to pure stands of alfalfa at herbage levels below 2500 kg DM/ha. On pure alfalfa stands, crude protein (CP) intake rates exceeded those on grass-dominated stands when herbage biomass exceeded 1700 kg DM/ha.
Intakes of CP (0.5 - 2 g/min) were similar below this biomass. A third order polynomial described the forage intake for wapiti in response to the complex structure of alfalfa dominated pastures. The study provides guidelines in terms of forage mixtures and grazing systems for the wapiti industry. Feeding standards are needed as the high costs of containment of wapiti have led to rather intensive pasture use.

65: Species limits of broad-clawed shrews, genus Cryptotis (Soricomorpha, Soricidae), in southeastern Mexico and Guatemala

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Five species of broad-clawed shrews (Cryptotis goldmani group) occur higher-elevation wet forest and cloud forest habitats in Mexico and Central America. Two of these species, Cryptotis griseoventris and Cryptotis goodwini, occur in close proximity in southeastern Mexico and Guatemala. Previously, a distinct difference in size, particularly of the skull, was the primary criterion used to distinguish populations of the larger C. goodwini from the smaller C. griseoventris. Recent collections of specimens from a broader geographic area have permitted more complete evaluation of a larger suite of characters from the post-cranial skeleton. This new information suggests greater diversity among populations than previously realized.

66: Heterochrony within a free-living population of spotted hyenas: Maternal effects, ecology and life history

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Variation in developmental rate among mammals is often heritable, and thus represents a potential target of selection. However, such variation can also result from plastic responses to the environment. We used morphological measurements from 20 consecutive years of immobilizations of spotted hyenas (Crocuta crocuta) in Kenya to investigate whether maternal, ecological, and life history traits influence postnatal ontogeny of a multivariate measure of size. The relative importance of these traits' effects on postnatal growth was assessed by incorporating them as predictor variables into commonly used growth models, and selecting among models using Akaike's Information Criterion. Maternal rank significantly affected developmental rate, and overshadowed effects of offspring size on the timing of important life history events such as weaning, with high-ranking individuals weaning at much younger ages, independent of size. Although adult spotted hyenas display significant female-biased sexual size dimorphism, sex did not affect developmental rate. Intra-litter rank was another important determinant of postnatal growth rate, with dominant littermates growing faster than subordinates, independent of maternal rank. These growth patterns may be caused directly by differential nutrition, or mediated through the action of metabolically-important hormones, such as IGF-1. Our results underscore the ubiquitous importance of social rank in spotted hyena ontogeny.

67: Surface morphology of lower incisors in relation to overwinter body temperature in Spermophilus tridecemlineatus

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Incremental growth structures evident on the surface of rodent incisors may record hibernation and other life history events. This study directly investigated overwinter body temperature profiles, their
relationship to incremental surface morphology of the incisors, and circadian periodicity of incisor
growth for free-ranging *Spermophilus tridecemlineatus*. We collared 15 individuals with
temperature-sensitive data recorders, periodically recaptured them for injection with oxytetracycline (to
serve as time markers in incisor dentin), followed collared individuals until immersgence, and recaptured
9 individuals post-emergence in spring. Data for recaptured individuals showed typical hibernation body
temperature patterns with a series of long torpor bouts punctuated by short arousal bouts, with the
longest and deepest bouts occurring during mid-winter. Surface morphology of incremental dentin and
associated enamel deposited during hibernation exhibited an array of morphological features consistent
with an extended period of metabolic depression. Incremental dentin pre- hibernation exhibited circadian
periodicity between oxytetracycline markers, but circadian periodicity was disrupted during the active
period immediately before and after hibernation in some individuals. Rates of active-season dental
growth showed a broad association with environmental temperature, but they were not correlated with
body temperature.

68: Comparison of wrist bones between ground, tree and flying squirrels using MIMICS image processing software

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We examined the carpal and metacarpal bones of a prairie dog (*Cynomys ludovicianus*), tree squirrel (*Sciurus niger*), and flying squirrel (*Glaucomys sabrinus*), using MIMICS image processing software, to
reveal differences in the mobility and functional morphology between the three major groups of
Sciuridae. A greater curvature of the proximal carpal joint, between the carpals and the forearm, permits
more medio-lateral movement in the flying and tree squirrels than in the prairie dog, with flying
squirrels permitted more deviation than tree squirrels. The prairie dog has more robust metacarpals and
phalanges than the other squirrels and hence broader distal carpal joints, which are matched with an
overall flatter proximal-distal arrangement of the carpal bones. The differing morphological
characteristics of ground, tree and flying squirrels reflect their adaptations respectively to digging, which
emphasizes ventro-dorsal flexion; climbing, which requires more medio-lateral movement; and gliding,
which requires more mobility yet for control of the wingtip. This exercise demonstrates how MIMICS
can be utilized to access, compare and display the mobility of joints in small vertebrates.

69: Miocene to Pleistocene faunal turnover within *Spermophilus* of the Great Plains

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Fossils from the Great Plains document a complex history of faunal turnover within the ground squirrel
genus *Spermophilus*. Middle Miocene species assigned to *Spermophilus* were small to moderate in size,
exhibited a unique combination of dental features, and showed no clear affinities with modern clades.
Late Miocene forms from the Great Plains were mostly moderate in size and exhibited primitive dental
features similar to the subgenus *Otospermophilus*. Squirrels exhibiting the *Otospermophilus*
morphotype persisted regionally well into the Pliocene before regional extirpation by the end of that
epoch. Ground squirrels probably representing clades within the polyphyletic subgenus *Ictidomys*
appeared regionally by the earliest Pliocene. They persisted to the present, although it is difficult to
distinguish phylogenetically divergent but dentally similar *S. spilosoma* from *S. tridecemlineatus* on
fragmentary dental evidence. The derived subgenus *Spermophilus* arrived on the Great Plains by the late
Pliocene and diversified to form several moderate to large-sized species, some convergent on the
prairie-dog morphotype. Finally, the subgenus *Poliocitellus*, today endemic to tall-grass prairie of
mid-continent North America, shows up near the Pliocene-Pleistocene boundary. The late appearance of *Poliocitellus* (~2.0-1.5 Ma) in the fossil record contrasts sharply with a published DNA-based divergence estimate for the lineage (8.1 Ma).

70: Where art thou *Ernanodon*? Morphological and morphometric analyses of † *Ernanodon* to Xenarthra and other mammals

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*Ernanodon antelios* was found in the Paleocene strata from Guangdong, China. When described, it was placed with Superorder Xenarthra. Xenarthrans are hypothesized to have originated from gondwanan ancestors, isolated on South America for ~90 million years. They are robustly supported as a monophyly. Since *Ernanodon* is a single specimen, most statistical test assumptions are violated. Two different approaches were therefore used. The first approach was a morphological investigation to evaluate the position of *Ernanodon* with extinct and extant xenarthrans, *Orycteropus*, two pholidotans, and *Didelphis virginiana* by scoring 167 characters. Data were analyzed with PAUP and Mr. Bayes. The convergent pholidotans group with the Pilosa. *Ernanodon* is sister taxon to *Didelphis; Orycteropus* is sister taxon to *Ernanodon*; Xenarthra is sister taxa to *Orycteropus*, supporting the hypothesis that *Ernanodon* does not belong to the Superorder Xenarthra. The second approach was a biomechanical morphometric investigation to examine variability of mobility among and within genera. Twenty-three measurements from 38 xenarthran, 19 eutherian, a metatherian and prototherian, and *Ernanodon* were used. Those data were analyzed with Principal Component Analysis. The results group all Xenarthra together within the 95% confidence ellipsoid and with a significantly different slope than all other mammals, including *Ernanodon*.

71: Growth, size, and sexual dimorphism in brown bears: Does size matter?

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We modeled skull growth from different regions of Alaska using over 10,000 known-age brown bears (*Ursus arctos*) and the von Bertalanffy equation. The growth curves showed markedly different rates of growth and asymptotic sizes across regions and these differences were likely influenced by variation in habitat quality, especially the availability of salmon (*Oncorhynchus* spp.), and correlate with variable life history patterns. Contrary to other studies of North American bears, we found a hyperallometric relationship in sexual size dimorphism where dimorphism increased with asymptotic size. This relationship supports sexual selection as the driving mechanism of sexual size dimorphism in brown bears and also suggests the intensity of sexual selection varies across regions.

72: Phylogeography of a holarctic shrew: The tundra shrew (*Sorex tundrensis*)

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The tundra shrew is currently recognized as the only holarctic soricid (Family: Soricidae), ranging from eastern Khazakstan in Eurasia eastward to the Yukon Territory in North America. The Holarctic nature of this species coupled with a limited North American distribution suggests its occurrence in North
America is recent, and that North American populations are the result of expansion from Eurasia, eastward across the Bering Land Bridge. We test these hypotheses and report on range-wide genetic signatures of the history of occupation for this species. Two genetic loci (sequenced for 65 individuals), mitochondrial Cyt b (1000bp) and nuclear apolipoprotein B (ApoB; 594bp), were used to investigate multiple populations from both Siberia and Alaska. Bayesian and distance analyses revealed relatively deep genetic structure within Siberia as opposed to shallow structure in Alaska. Population genetic analyses pinpoint stable populations within Siberia but signatures of population expansion in Alaska. Phylogeographic breaks between well supported clades are consistent with mountainous regions dissecting lowland areas where current populations occur and suggests persistence in discreet areas of ice-free Siberia during the last glacial episode. Alaskan shrews form a well supported monophyletic group but are minimally diverged from Eurasian shrews suggesting a recent expansion eastward through Beringia.

73: Linking genetic structure to landscape structure: *Glaucomys sabrinus coloratus* in the southern Appalachians

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Understanding the interaction between geography and dispersal patterns is particularly relevant for conservation at the landscape scale. This understanding is increasingly important for conservation at the edges of organisms' distribution ranges, where climate change is expected to alter habitat mosaics and lead to range shifts and possible extinctions. We assessed the influence of habitat connectivity, topography, and human modifications of the landscape on gene flow in the Carolina flying squirrel *Glaucomys sabrinus coloratus*. We sampled 286 individuals across the subspecies' range, and examined genetic structure using 8 microsatellite markers and mitochondrial D-loop sequence data. While genetic structure is evident at the broad scale for both markers and shows a significant pattern of isolation by distance, between-region divergence values (Rho) range widely from no significant difference to 0.37. We used a GIS-based approach to assess correlations between genetic subdivision and landscape variables such as distance, habitat type, topography, and potential barriers. We evaluated dispersal models, including stepping stone and least-cost habitat pathways, using Akaike’s information criteria. The data suggest that habitat connectivity plays a large role in shaping gene flow patterns of the Carolina flying squirrel. The results are particularly relevant for evaluating current and proposed conservation strategies for the subspecies.

74: Phylogeographic relationships of South American grass mice *Akodon* (Rodentia, Cricetidae)

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The genus *Akodon* (Rodentia, Cricetidae) is among the most speciose groups of South American rodents, second only to the genus *Oryzomys*, where its 65 extant named forms (species and subspecies) occur from northern Venezuela to southern Argentina. Despite high diversity, results from previous studies have been limited by taxonomic and geographic sampling. For this study, tissue samples from 200 individuals, representing 63 taxa of the Tribe Akodontini, have been obtained via collection of wild specimens or via museum specimens. Four genes (cytochrome b, dentin matrix protein, acrosin, and thyrotropin) have been selected based upon their widespread usage in mammalian systematics allowing
for comparisons to other groups and expected utility for resolving relationships within the genus Akodon. Preliminary results from 49 individuals of Akodon, sequenced for all four genes, were analyzed using maximum parsimony, minimum evolution, maximum likelihood, and Bayesian analyses to clarify the evolutionary relationships among the lineages of the genus and to investigate the present distributions and historical biogeography of the genus as it relates to major South American habitats.

75: Investigation of lice and pinworm coevolutionary histories with chipmunk (Genus Tamias) hosts

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Coevolutionary studies of hosts and parasites provide insight into fundamental evolutionary processes that drive adaptation and speciation. Evolutionary histories of parasites also provide independent perspectives on the biogeographic history of the host. Chipmunks (genus Tamias) represent an ideal host system to investigate coevolutionary histories because of their complex phylogenetic history and high infection rate of sucking lice and pinworms. Western North American species of chipmunks are infected with two species of sucking lice; Hoplopleura arboricola and Neohaematopinus pacificus, and at least three described species of pinworms; Syphacia eutamii, S. obvelata, and Heteroxynema cucullatum. Incongruence between mitochondrial and nuclear gene trees from a monophyletic group of six Tamias species suggests a possible lack of lineage sorting, introgression, or both among four species; T. cinereicollis, T. dorsalis, T. quadrivitattus, and T. umbrinus. These paraphyletic relationships vary over geography in the southern Rockies/Great Basin region and suggest that the biogeographic history of the individual host species has contributed to these patterns. To provide additional insight into the evolutionary history of these chipmunks and their parasites, we generated mitochondrial gene trees for both louse species and one pinworm species (S. eutamii) and interpreted those relationships within the phylogeographic framework of the hosts.

76: Landscape genetics of swamp rabbits in southern Illinois

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Swamp rabbits (Sylvilagus aquaticus) are threatened by habitat loss and fragmentation at the northern edge of their range. Crucial bottomland hardwood forest habitat, once abundant in the Ohio and Mississippi River valleys, has been replaced by agricultural land use that negatively affects connectivity of swamp rabbit populations. We are conducting landscape-genetic analyses to investigate how spatial structure of habitat affects swamp rabbit dispersal and persistence in southern Illinois. During 2006-09, swamp rabbit DNA was obtained via ear punches from trapped animals and fecal pellets collected from natural and artificial latrine logs. Genetic subdivision and discontinuities were evaluated by examining differences in the distribution and abundance of polymorphic microsatellite markers developed for the eastern cottontail (S. floridanus), pygmy rabbit (Brachylagus idahoensis), and European rabbit (Oryctolagus cuniculus). Nineteen microsatellite loci showed an average polymorphism of 3.2 alleles per locus. Even with low polymorphism, genetic differences among swamp rabbits in different locations along the same watercourse indicated that gene flow through suitable habitat was low. Because gene
Flow was limited despite connectivity provided by corridors of suitable habitat we suggest that metapopulation dynamics play an important role in shaping the genetic structure of swamp rabbits.

77: Mitochondrial DNA variation in golden mice (Ochrotomys nuttalli) populations from fragmented and continuous landscapes

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Phylogeography of the golden mouse, Ochrotomys nuttalli, was investigated by sequencing a 290 bp region of the mitochondrial DNA control region in 77 individuals collected from Florida (n=62) and North Carolina (n=15), USA. The sequenced region revealed 29 variable sites and 21 genetic haplotypes. Ochrotomys nuttalli from North Carolina displayed more genetic diversity (11 haplotypes) than those from Florida (10 haplotypes), likely reflecting larger local population sizes. Within Florida, the topology of a bootstrap consensus neighbor-joining tree closely reflects landscape features. Golden mice are highly associated with hardwood-containing habitats at their southern range periphery and occur predominantly in scrub - an ecosystem with a patchy distribution. Genetic analysis of Florida Ochrotomys nuttalli resulted in three major clades: 1) the Atlantic Coastal Ridge, 2) a central-western ridge group, and 3) the panhandle. Differentiation on the Atlantic Coastal Ridge is explained by the fact that this narrow stretch of scrub along the east coast is largely removed from similar habitat. The genetic distinctness of panhandle golden mice may be a relict of a different southern refuge of these mice during the Pleistocene or the Suwannee Seaway, a waterway thought to have divided peninsular Florida from the US mainland into the Pliocene.

78: Comparative phylogeography of alpine mammals in eastern Beringia

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Increasing evidence is emerging to suggest that alpine-associated organisms were perhaps more broadly distributed during times of past glaciation and are currently restricted to "interglacial refugia." In Alaska this scenario may be even more extreme, as fossil evidence suggests that mammals that are currently restricted to the alpine were more broadly distributed on the mammoth steppe. We examine comparative phylogeographic patterns in five alpine species found in southcentral Alaska (Ochotona collaris, Marmota caligata, Microtus miurus, Spermophilus parryii, and Lemmus trimucronatus). Four of these species show evidence of an east-west suture between populations in the Wrangell-St. Elias region. We compare these patterns to those found in other co-distributed lowland taxa and propose possible reasons for discordance. We also use an approximate Bayesian computation method to test whether the East-West phylogeographic splits within species are temporally concordant. We also use Bayesian skyline plots to examine population fluctuations in alpine and lowland taxa, and find that alpine taxa appear to have undergone population contraction while lowland taxa have experienced expansions.
79: PCR identification of mammalian hosts of fleas

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Because plague, caused by the bacterium *Yersinia pestis*, causes the death of 90-100% of black-tailed prairie dogs (*Cynomys ludovicianus*) in a colony, it has been argued that another small rodent is necessary to maintain and spread the disease. Northern grasshopper mice (*Onychomys leucogaster*) share fleas with many rodents, including prairie dogs, but it is not clear if prairie-dog fleas can feed on and therefore transmit the disease to grasshopper mice. We used PCR assays and gel electrophoresis to identify the source of bloodmeals in three species of engorged fleas combed from their primary rodent hosts (prairie dogs, and thirteen-lined ground squirrels *Spermophilus tridecemlinatus*) and from grasshopper mice. Most (53-82%) fleas combed from their primary hosts contained the DNA of their primary hosts. Most (52-57%) fleas typically associated with prairie dogs and ground squirrels but combed from grasshopper mice contained grasshopper mouse DNA. A large fraction (18-48%) of fleas contained bloodmeals with no identifiable rodent DNA, suggesting that their bloodmeals had already been digested. Our results indicate that grasshopper mice are fed upon by fleas usually associated with prairie dogs and other rodents, suggesting a possible role in the transmission and persistence of plague in prairie dog colonies.

80: Evidence that urbanization alters host-parasite dynamics in coyote populations

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Coyotes in rural systems are an important host of canine heartworm; however, our current knowledge of coyote-heartworm dynamics within urban landscapes is limited. We used serology and necropsy data from coyotes in the Chicago metropolitan area to examine heartworm prevalence and model risk factors associated with infection. Although a recent study indicated that heartworm prevalence in rural northern Illinois was <5%, we found that heartworm prevalence in the Chicago regions was relatively high. Of 85 coyote serum samples and necropsies of 62 carcasses, 27% and 42% were positive for heartworm infections, respectively. Adult coyotes had 3-4 times the odds of being infected than young coyotes; sex, year, season, habitat use, and social status were not significant. To examine the influence of urban development in heartworm transmission we constructed Heartworm Transmission Seasons (HTSs) for an urban to rural gradient. Duration of HTSs close to the urban core was significantly longer than HTSs in rural landscapes, indicating that large urbanized landscapes act as 'heat islands', amplifying heartworm infection through longer transmission periods. The results of our study are a demonstration of altered parasite dynamics within an urbanized area.

81: Distribution of small mammals and pathogens along an elevational gradient

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We sampled 7 sites in Rocky Mountain National Park and Roosevelt National Forest in 2007-2008 for small mammals and associated pathogens to examine and evaluate spatial patterns between sites with regards to diversity, space, parasites, and diseases. Mammal species diversity was consistent at sites, with 4 of 7 sites showing the same pool of 6 species, and 2 other sites quite similar to these. Blood samples from deer mice (*Peromyscus maniculatus*) were tested for hantavirus; fleas and blood samples
from all species collected were tested for plague infection. We found significant differences of hantavirus prevalence between some pairs of sites, but no clear pattern was not evident, mainly between sites where hantavirus was not detected versus sites with low sample size and high prevalence—as such, we do not assign great biological weight to these differences. We found no significant patterns in hantavirus prevalence with respect to elevation, geographic distance, and biological. We did not detect any plague presence, neither as antibodies in mammal blood nor as DNA fragments in fleas.

82: Sizing up big-legged bat flies: A morphometric approach to species boundaries within the genus *Megistopoda*

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Streblid bat flies are obligate, bloodfeeding ectoparasites of bats, richest on the Phyllostomidae. Three species of the fly genus *Megistopoda* have been described, all of which parasitize species of *Artibeus* and *Sturnira*. These flies belong to morphologically confusing complexes of potentially cryptic species. A gradient of morphological variation appears to exist among *Megistopoda* spp., from a generalized trichobiine form to a more specialized form characterized by lengthened hind legs, narrowed wings, and narrowed thorax. To explore apparent gradients of morphological variation, 18 characters from *Megistopoda* parasitizing 13 bat species (termed "unique associates") were measured and subjected to multivariate analyses. Results indicate that two species groups (aranea and proxima) exist. Within species groups, variation among unique associates was less demarcated. Multivariate Analysis of Variance determined most unique associates were distinct in overall morphology. Specifically, characters weighing heavily in delimiting these boundaries were length and width of wings, length of legs, and shape of thorax. It is clear that a revision of *Megistopoda* is needed to resolve these issues. Ongoing molecular studies may serve to illuminate species boundaries among these morphologically similar taxa, and allow us to address potential co-speciation between these bat flies and their host bats.

83: Ectoparasite and serosurvey of mountain lions (*Puma concolor*) in southwestern Arizona

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The understanding of disease epizootiology in wild felid populations is expanding. However, it is extremely limited in some species and in regions such as Arizona. Serosamples and ectoparasites were taken from 9 radio-collared mountain lions (*Puma concolor*) in southwest Arizona between January 2006 and December 2007. Samples were tested for evidence of exposure to 8 common feline viruses, canine distemper virus (CDV), and *Toxoplasma gondii* (FeTx). The highest incidences of exposure were: feline toxoplasmosis 89% [8/9], feline panleukopenia virus (FPLV) 78% [7/9] and feline calicivirus (FCV) 67% [6/9]. One male was seropositive for CDV, FeTx and FPLV. Tissue samples were collected post-mortem and tested for amplicons of CDV using immunohistochemistry (IHC) and presence for viral antigens of FeTx and FPLV using polymerase chain reactions (PCR). All results were negative for presence of CDV, FeTx and FPLV. We collected ectoparasites from 3 individuals identified as *Pulex iritans*, a species of flea not commonly found on mountain lions. As humans encroach into habitats for large predator's managers and biologists should take advantage of the opportunities to better understand disease epidemiology of wild carnivores for enhanced management of
all organisms sharing the landscape.

84: The ecology, evolution, and host associations of monkeypox

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Monkeypox (MPX) is endemic to the Congo Basin area and sub-Saharan Africa, but in 2003 infected people in the midwestern United States; the first report of human infections outside of Africa. This event spurred research to learn more about the ecology of this disease, the development of a better MPX model for the study of anti-viral treatments and post-exposure prophylactics and efforts to reduce or prevent the re-importation of MPX into the US. Historically, several efforts have been made to identify the sylvatic source of human MPX. Data from these investigations, as well as from the US MPX outbreak in 2003, narrows the list of plausible reservoir species, however, the species or suite of species which represent the natural source or reservoir of monkeypox is poorly understood. This presentation details the progress to date regarding historic and current data from field and laboratory studies on the ecology and potential reservoir host associations of MPX in Africa.

85: Prairie dog model of systemic orthopoxvirus disease using West African and Congolese strains of monkeypox

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Human monkeypox manifests as a febrile rash illness similar to smallpox but is a zoonotic disease endemic to Africa, albeit of worldwide concern (evidenced by the US 2003 outbreak). Two distinct Orthopoxvirus monkeypoxvirus (MPXV) clades, West African/Congo Basin, have unique manifestations. Multiple MPXV animal models have been reported; none demonstrated protracted asymptomatic incubation phases seen in humans. We characterized infection with the two clades using a prairie dog (Cynomys ludovicianus) model. In our initial study, for each strain, 4 animals were inoculated with $10^{4.5}$ p.f.u. by intranasal route(IN), 4 by scarification. Secondary lesions became apparent after 9-12 days. Individual animals demonstrated symptoms consistent with human disease. Levels of viable virus were similar for both strains, shedding occurred until day 21. Higher levels of mortality were observed in Congolese MPXV challenged animals. A subsequent dose-range study was conducted infecting animals IN with $10^{3}$-$10^{6}$ p.f.u. for each strain. This allowed further characterization of the model and the calculation of LD$_{50}$ values for each. With these studies, we have shown the prairie dog is valuable for the study of strain-dependent differences in MPXV. Additionally, the model closely mimics human disease and may have value for medical countermeasure studies.
86: Associations of the tick, *Ixodes angustus*, on small mammal hosts from South-central and Southeastern Alaska

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Infestation parameters were determined for 908 ticks, *Ixodes angustus* collected from 245 individual mammals from 6 of 9 sites located in South-central and Southeastern Alaska from May 29 to June 18, 2008. The tick stages collected were larvae (n=715), nymphs (n=131), adult females (n=56) and adult males (n=6) in various stages of engorgement. *Ixodes angustus* were recovered from 12 of the 14 mammal species examined for ectoparasites. *Ixodes angustus* were present on *Sorex cinereus* (n=66), *Myodes rutilus* (n=60), *Microtus longicaudus* (n=23), *Myodes gapperi* (n=21), *Microtus pennsylvanicus* (n=19), *Sorex monticolus* (n=16), *Peromyscus keeni* (n=16), *Peromyscus maniculatus* (n=4), *Synaptomys borealis* (n=4), *Zapus hudsonius* (n=4), *Microtus oeconomus* (n=6) and *Tamiasciurus hudsonicus* (n=3). Eight of the twelve mammal species had infestation prevalence higher than 60%, *Microtus oeconomus* (6/6, 100%), *Peromyscus keeni* (13/16, 81%), *Peromyscus maniculatus* (3/4, 75%), *Synaptomys borealis* (3/4, 75%), *Myodes rutilus* (42/60, 70%), *Sorex monticolus* (11/16, 69%) and *Sorex cinereus* (45/66, 68%). These results demonstrate that small mammals in coastal Alaska are frequently infested by *Ixodes angustus*, and suggest that tick-borne infections may perpetuate in robust enzootic transmission cycles in this region.

87: The effect of moon phase on habitat use and movement of bobcats

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For centuries, moon phase has been used to predict movement of animals for increased hunting success. Recent studies have determined that moon phase may affect predator-prey relationships. Understanding changes in movements and habitat use based on moon phases provides important life history information on species and may assist biologists in making land management decisions. The objective of this research is to determine the impacts of moon phase on bobcat (*Lynx rufus*) movements in eastern North Carolina. Bull Neck Swamp Research Forest is 2,492 hectares and one of the largest remaining tracts of undeveloped private waterfront property on North Carolina's Albemarle Sound. We analyzed movements using over 4,000 GPS data points acquired March - October 2008 from 4 bobcats, segregating moon phases into pre-new moon, new moon, pre-full moon, and full moon. Also, we added distance to roads to evaluate if bobcats used roads differently during the moon phases. Bobcats moved more during full moons and moved on roads more during new moons. This research suggests bobcats depend on interior forests for cover during full moon phases and are more likely to use open areas when light availability is low during new moon phases.
88: Microhabitat selection by bobcats in the badlands region of South Dakota

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We characterized microhabitat selection for bobcats (Lynx rufus) inhabiting the Badlands of southwestern South Dakota. A total of 10 bobcats (6m, 4f) was fitted with store-on-board GPS collars. Twenty variables were measured at 187 locations used by bobcats. Data were analyzed using both stepwise logistic regression and a priori modeling. We determined that sex specific habitat selection was not significant (P= 0.18); therefore, data were pooled for sexes. Results using the pooled data indicated that bobcats selected for low vertical cover, small shrubs, tree diameter, bare ground, distance to drainages, slope, and distance to badland formations. This model was derived through a stepwise logistic regression process with a p-value of 0.2 to enter and/or remain in the model with parameters being: Wᵢ=0.75, -2LL=415.965, AIC of 431.965, and a c-value of 0.71. Our results were similar with studies of various ecotypes, with low vertical cover, distance to drainages, and rock outcroppings being identified as important features. While no rock outcroppings were found in our study area we believe that badland formations play a similar role. Our results indicate that bobcats are an adaptable species with an ability to inhabit a variety of landscapes.

89: Ocelot (Leopardus pardalis) latrines yield data on ecology and behavior

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Ocelots in Panama make extensive use of latrines for deposition of feces and urine. Data from video and still camera-traps, and collection of scats, revealed that latrines are regular stopping place for individuals of both sexes. We gathered information relating to activity patterns, circadian rhythms, and diet of ocelots (Leopardus pardalis), as well as activities of several other species on Barro Colorado Island (BCI), Panama. Five ocelot latrines were used by specific subpopulations of 4 to 6 ocelots over periods of several months to three years. We used spot patterns to identify individuals. Latrines appear to have social functions other than the marking of territory. Other species that visited the latrines included coatimundi (Nasua narica), opossum (Didelphis marsupialis), tayra (Eira barbara), and vultures (black and turkey). Coatis, opossums, and vultures ate ocelot scats, and coatis and opossums rolled and rubbed their fur where the scats and urine were concentrated. Other cat species did not appear at the latrines, although pumas, jaguarundis, and margays were all documented at camera traps on the study site. Ocelot scats were collected and analyzed to identify and quantify a wide variety of prey.

90: Wolverine capture, home range, and movements in northern Southeast Alaska

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Wolverines (Gulo gulo) are vulnerable to over harvest because of large home range areas and long distances they can travel. A highway through roadless terrain along Lynn Canal linking Juneau with the mainland road system has been proposed. To evaluate potential effects of the road project, we captured and collared wolverines in Berners Bay, 60 km north of Juneau, during 2008 and 2009. We captured wolverines using a modified log box-trap. During 2008, we captured 4 wolverines (2 M, 2 F) 9 times during 701 trap nights. During 2009, we captured 7 wolverines (5 M, 2 F) 8 times during 237 trap nights. We deployed Lotek GPS collars on all captured wolverines. During 2008, we recovered 3 of 4
GPS collars. During 2009, we deployed 7 GPS collars. To date, we have data from 3 wolverines (1 M, 2 F). One male had a 100% MCP home range of 263 km². He made repeated circuits of his home range, regularly covering the 26 km length in a day or two. Mean female home range was 54 km², but was based on only a few weeks of data. We will discuss home range and movements from wolverines collared in 2009.

91: Female reaction to male urine scents as an indicator of mate choice in captive cheetahs (*Acinonyx jubatus*)

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Individual captive cheetahs (*Acinonyx jubatus*) are assigned mates based primarily on genetic relatedness; however, evidence from many species suggests that allowing animals to choose mates increases breeding success. Several studies of small mammals have shown that animals are able to decipher genetic compatibility from urine. This study tested whether female cheetahs appeared to differentiate genetic relatedness to males by their urine scent. Females (n=7) were offered three urine scents: one from an unrelated male (a good mate choice), another from a male that was equivalent to a second cousin (an average mate choice), and one from a male that was closely related, equivalent to a brother/father (poor mate choice). Every female was offered a "blank" scent as a control. Time spent and specific behaviors displayed toward each scent were recorded. Voided male urine was collected following scent marking. The estrous cycling of each female was monitored through fecal hormone evaluation for the 2 weeks prior, during and the 2 weeks after the urine scent trial. Preliminary results do not reveal a significant preference by the females for any urine sample type, although additional test are being conducted to increase the sample size.

92: Contact structure of white-tailed deer in New York: Informing risk models and management decisions.

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Contact rates are an essential component of disease transmission and may be influenced by seasonal, behavioral, and spatial aspects of the population in question but few specific data are available to parameterize models. Our objectives were to quantify those rates empirically across time and space. We used GPS movement data from 71 white-tailed deer (*Odocoileus virginianus*) to quantify potential direct (deer-to-deer) and indirect (deer-to-previously-occupied-space) contact rates across time and space in central New York. We observed increased daily probabilities of direct contact in winter, dropping to low levels post-parturition through summer, and increasing during the rut to winter levels. The cumulative distribution function for the spatial structure of direct and indirect contact probabilities increased rapidly with distance from 1,000m - 7,000m. Ninety-five percent of the probabilities of direct contact were accounted for within 8,500m and 99% within 10,900m. Probabilities of indirect contact accumulated across greater spatial extents: 95% at 11,900m and 99% at 49,000m. Spatial contact structures were consistent across seasons, suggesting that although contact rates differ seasonally, they occur proportionally across similar landscape extents. Distributions of primary contact probabilities across space may inform managerial decisions for assessing risk and allocating resources in response to disease detection.
93: White-tailed deer space use and resource selection: Implications for disease spread

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Patterns of habitat use inform our understanding of the biological requirements and behavioral decisions made by individuals, and ultimately assist ecologists in managing and conserving wildlife populations. This information is especially useful in understanding the dynamics of infectious diseases like chronic wasting disease (CWD) in white-tailed deer (*Odocoileus virginianus*). We analyzed data from 71 GPS collars deployed on white-tailed deer to evaluate the behavioral and spatial parameters associated with patterns of habitat utilization and resource selection. We used kernel density estimation to identify multiple use areas across sex and age classes and evaluated the influence of landscape configuration on home range size and developed conditional logistic regression models to illustrate habitat use versus availability among study animals. Home range size was negatively correlated with fragmentation intensity such that animals utilize more space in landscapes where patch types are more aggregated, more evenly distributed, more proportionally diverse, and contain low patch richness. In addition, selection for specific landscape attributes was influenced seasonally by sex. These data provide the first of several fine-scale estimates of factors that are likely to contribute to space use of animals, and ultimately to our understanding of the manner in which infectious diseases spread across the landscape.

94: Red and arctic foxes on the Saint Matthew Islands: Can they coexist?

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The red fox, *Vulpes vulpes*, has reached St. Matthew and Hall islands in the northern Bering Sea in recent decades, has established a breeding population there, and appears to be suppressing the native arctic fox, *Alopex lagopus*. The genetic source of the colonizing red foxes is being investigated at the Museum of the North, UAF. The island complex is part of the Alaska Maritime National Wildlife Refuge and is noteworthy for its high numbers of colonial nesting seabirds, an endemic vole, *Microtus abreviatus*, and an endemic bird, the McKay's snow bunting, *Plectrophenax hyperboreus*. Establishment of red foxes on St. Matthew and Hall islands may be associated with accelerated climate change in that region in recent decades. Complex questions for conservation of the life forms present in this insular ecosystem that are posed by the addition of a new mammal species include: How do red and arctic foxes differ in their predatory behavior and what are the consequences for colonial and ground nesting birds and the endemic vole? Will the red foxes ultimately extirpate the arctic foxes? Will an insular red fox population be sustainable in a changing climate characterized by increased variability in frequency and severity of storm events?

95: Seasonal changes in field metabolic rate, FMR, of captive northern red-backed voles, *Myodes rutilus*

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Voles and lemmings are common rodents and important prey species in most Northern high-latitude ecosystems. They remain active and maintain a constant body temperature year round, in spite of their small body size and the often extreme cold of the Northern winter. We are studying seasonal and environmental effects on the field metabolic rate (FMR) of northern red-backed voles, *M. rutilus*, housed at the Alaska Zoo in Anchorage, Alaska. We are using the doubly labeled water method to measure
FMR and comparing this with measurements of snow depth, \( T_A \), ground temperature, nest box temperature, and photoperiod over a 12 month period. We predict that FMR will be lowest in summer because of the warmer ambient temperatures, second lowest in winter because of the insulative properties of the snow cover and highest during Fall and Spring because of the thermodynamic challenges associated with repeated melting and freezing of the snow and ice. Our study will help predict the energy expenditure of a species that is crucial to many Alaskan food webs and will help to predict possible impacts of climate change on behavior and population dynamics of *M. rutilus*.

**96: Phylogenetic relationships among species of chipmunks (*Tamias*) from the Great Basin and southern Rockies**


The bulk of species diversity within chipmunks (*Tamias*) is centered on western North America where 23 of 25 recognized species occur across a wide range of habitats. In the southern Rockies and Great Basin, seven species (T. canipes, T. cinereicollis, T. dorsalis, T. palmeri, T. quadrivittatus, T. rufus, and T. umbrinus) comprise a monophyletic group with taxa readily differentiated by bacular morphology. Previous phylogenetic studies (e.g., Levenson et al. 1985, Piaggio and Spicer 2001) have highlighted the complex relationships within this clade and in particular, mitochondrial analyses have uncovered paraphyly suggested to be a result of recent divergence and incomplete lineage sorting among species (Piaggio and Spicer 2001). However a viable alternative hypothesis, introgressive hybridization, is also possible given that it explains other non-monophyletic relationships within Tamias (Good et al. 2008). To assess this, we present preliminary mitochondrial and nuclear phylogenetic estimates based on sequence data from more than 125 individuals representing six species, with extensive intraspecific sampling across seven states in the southern Rockies and Great Basin. Our results point to additional complexity within this group of chipmunks and suggest a geographic component to instances of mitochondrial paraphyly that is related to contact zones between species.

**97: Small-mammal monitoring in Denali National Park and Preserve, Central Alaska Network**

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Three vole species, *Myodes rutilus*, *Microtus oeconomus* and *Microtus miurus*, have been monitored in Denali National Park and Preserve (DENA) since 1992 using mark-recapture methods. Our objective is to continue monitoring the abundance of small-mammal populations on the Rock Creek legacy plots in DENA in perpetuity. Short life spans, high reproductive rates, and restricted movements cause small-mammal population numbers to reflect local conditions and make them useful for detecting change in boreal ecosystems over time. In 2008, 400 Sherman live traps were deployed and checked 3 times daily from August 13-16. Captured individuals were identified by sex, species, and reproductive status. Unmarked individuals were implanted with passive integrated transponder tags, scanned and released. Every tagged individual was identifiable for capture/recapture estimates of population size. A total of 5200 trap checks and 1301 total captures (400 new and 901 recaptures) occurred during the sampling period. Of the new captures, 343 (85.75%), 38 (9.50%) and 19 (4.75%) were *M. rutilus*, *M. oeconomus* and *M. miurus*, respectively. Abundance estimates for each species by plot were: *M. rutilus* RF1=190 (SE=30.5941), RF2=182 (SE=33.0454), RR1=127 (SE=24.9800), RR2=82 (SE=17.6635); *M.
98: Do naturally occurring differences occur in maternal licking and grooming profiles in rats in semi-natural environments?

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Organisms are in perpetual interplay with their environments. Behavioral, hormonal and neurobiological phenotypes are often contingent on context. Most laboratory studies factor environment 'out' of experiments by standardizing treatments, conditions and housing. To improve the validity of our animal models we must attempt to factor context back in. The relationship between early rearing and the regulation of behavioral, endocrine and neurobiological responses to stress is well characterized in the rat under laboratory conditions. Greater levels of maternal licking and grooming (LG) received by a rat pup results in attenuated stress-reactivity phenotypes later in life. Maternal and stress profiles can also be non-genomically transmitted across generations. We examined the dynamic relationship between rat dams and offspring in two conditions: Rats initially bred in a standardized animal facility and then subsequently bred at a Field Station for Behavioral Research (UC Berkeley-FSBR). Ten Long-Evans female rats were initially bred and LG scores recorded. After weaning, females were transported to the FSBR and rebred. At the FSBR rat dams were housed one per room with all rooms exposed to ambient natural conditions. Our initial findings indicate a strong positive correlation in maternal LG profiles across the two very different environmental conditions.

99: Variation in the southern short-tailed shrew (Blarina carolinensis): A preliminary report

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The southern short-tailed shrew (Blarina carolinensis) inhabits the Mississippi Alluvial Plain, the Gulf Coastal Plain, Florida, and the Atlantic Coastal Plain as far north as Virginia. Originally described by Bachman (1837), this species has had a long and convoluted history. A study conducted in 2006, which compared cranial measurements of the three subspecies of B. carolinensis found in Florida, showed that there was a small population whose measurements were significantly different from other populations of Blarina in the state. This study resulted in the recognition of another species, B. shermani. We wondered what would happen if we performed a similar study using B. carolinensis from across the species' entire distribution. Specimens were borrowed from 23 museums, and the following cranial measurements were taken for each specimen: occipito-premaxillary length, cranial breadth, maxillary breadth, interorbital breadth, height of mandible, articular breadth, and length of maxillary toothrow. Currently we have 1,213 specimens that have been mapped, of those nearly 1,000 that will be used in analyses. These measurements will help determine whether there are any populations of B. carolinensis that are distinct from other named populations.
100: Strange things done under the midnight sun: Echolocation-call characteristics of little brown bats (*Myotis lucifugus*) at the northern edge of their range

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Little brown bats (*Myotis lucifugus*) reach the northern edge of their range in Yukon, Canada. At higher latitudes they encounter short, luminous, and cool nights, relative to conspecifics at lower latitudes. *M. lucifugus* is frequently the only bat in local assemblages in the North, and they face little niche competition with ecomorphologically similar species. We were interested in how echolocation-call characteristics may be influenced by environmental conditions in the North, and the lack of competition with congeners. We recorded echolocation-calls from *M. lucifugus* along a latitudinal gradient in western Canada. Echolocation-calls of *M. lucifugus* in northern populations were steeper than conspecifics further south, and similar to those of *M. septentrionalis* and *M. keenii*, which glean insects in cluttered habitats. Our data suggests that little brown bats in the North have evolved echolocation-call designs more suitable to foraging in cluttered habitats, likely in response to: high light levels and increased predation risk; cool temperatures and an increased need to access non-volant prey; and, possibly, a lack of competition with congeneric species. Little brown bats at the northern edge of their range appear to be better able to exploit a variety of habitats and prey, given their echolocation-call characteristics.

101: Behavioural responses of hoary marmots (*Marmota caligata*) to alpine hikers in central Yukon

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Outdoor recreation activities in wilderness areas, such as hiking, may have profound impacts on wildlife populations through disturbance and disruption of activity patterns. We conducted an experimental study to assess the behavioral response of a relatively naïve population of hoary marmots (*Marmota caligata*) to alpine hikers in central Yukon, Canada. Two disturbance trials were compared: those involving a lone hiker and those involving a hiker with leashed dog. Activity budgets before and after disturbance trials were compared. Marmots did not react significantly different to lone hikers versus hikers with leashed dogs in terms of alert distance, flight initiation distance, or time spent in the burrow. Analysis of activity budget data, however, showed that hoary marmot activity patterns were significantly different before and after disturbance events ($P < 0.001$). After disturbance by hikers, marmots spent significantly less time foraging ($P = 0.035$) and significantly more time vigilant ($P = 0.004$). While linkages between behavioral responses and population-level effects (i.e. survival and fitness) are not clear, we recommend that park managers route hiking trails to reduce impacts to marmots. Our data suggest that trails be constructed $\geq 200$ m away from marmot colonies and key foraging habitat to avoid disturbance.
102: Lousy wolves: Distribution of *Trichodectes canis*, an invasive ectoparasite of Alaska gray wolves

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In 1981 *Trichodectes canis* (Ischnocera: Trichodectidae), was first documented in wolves on the Kenai Peninsula, Alaska. Transmission of *T. canis* occurs through direct physical contact. Since its first documentation, *T. canis* has been found in the Matanuska-Suitua River Valleys in 1998 and north of the Alaska Range in 2005. Two hypotheses may explain why *T. canis* has not been observed in Alaskan wolves until the 1980s. Symptomatic wolves could be predisposed to pediculosis, while individuals outside of the observed infestation region possess inconspicuous mild infestations. A second possible explanation is that *T. canis* is an invasive ectoparasites, and wolves outside of the infestation region do not harbor *T. canis*. Our objectives were to determine *T. canis* current distribution in Alaska wolves and test the hypothesis that *T. canis* is a natural parasite of Alaska wolves. Wolves across Alaska were examined using potassium hydroxide hide digestion, visual and histopathology inspection, and verbal reports from regional wildlife biologists. We found indications of *T. canis* within the Kenai Peninsula, Matanuska-Suitua River, Chena and Tanana Rivers, and Kuskokwim River Valleys. Current distribution and absence of *T. canis* outside present infestation regions suggests lice are novel parasites within Alaska.

103: Bone mineral density is conserved during hibernation in arctic mammals

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Arctic ground squirrels (*Spermophilus parryii*) and American black bears (*Ursus americanus*) undergo a 5-7 month period of inactivity during which body temperature, metabolic rate, and heart rate are reduced. These prolonged periods of inactivity could potentially lead to a loss of bone mineral density (BMD) and thereby detrimentally affect other life history stages. We used dual-energy x-ray absorptiometry, DXA, to measure the BMDs of captive *S. parryii* and *U. americanus* at the beginning and end of hibernation. During hibernation, *S. parryii* showed a significant decrease in body mass but maintained femoral bone mineral stores from its onset to its conclusion. There was no effect of temperature (+2 °C vs. -10 °C) or duration of hibernation (45 to 183 days) on overall change in BMD, but each had effect upon overall change in body mass. *Ursus americanus* (n=4) was similar to *S. parryii* in that while it also showed a significant decrease in body mass, the small decrease in phalanx BMD that was observed in this species during hibernation was not significant. The ability of arctic hibernators to conserve bone mineral stores during winter contrasts with the winter osteopenia observed in non-hibernating arctic/subarctic rodents, such as northern redbacked voles *Myodes rutilus*.
104: Dual-energy X-Ray absorptiometry (DXA) can accurately and nondestructively measure the body composition of small, free-living rodents

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Dual-energy x-ray absorptiometry (DXA) is a nondestructive technique that can potentially measure specific components of whole-body composition in free-living and lab-raised animals. Our aim was to test the ability of DXA to measure the composition of a common arvicoline rodent, the northern redbacked vole (\textit{Myodes rutilus}). We used a DXA apparatus to obtain measurements of fat mass (FM), lean mass (LM), bone mineral content, bone mineral density, and fat-free mass (FFM) in carcasses of free-living and lab-raised voles. We then used chemical carcass analysis to derive predictive algorithms for actual values of FM, total body water, total protein, total mineral, LM, and FFM. Unexplained error in the equations for all voles grouped collectively ranged from $R^2 = 0.82$ to $R^2 = 0.98$. The DXA FM measurement had the highest coefficient of variation, and it was higher for free-living voles than for lab raised voles. However, FM can be determined by difference with excellent precision by using the FFM equation ($R^2 = 0.98$). We also derived corrective terms for passive integrated transponder-tagged animals. Thus, DXA is a nonlethal, nondestructive tool capable of precisely and accurately measuring many specific parameters of whole-body composition in small free-living and lab-raised rodents.

105: Integration of the University of Illinois Collection complements mammalogy at the Museum of Southwestern Biology

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Museum specimens are of critical importance to research of mammalian diversity. Current trends in biodiversity loss, environmental degradation, and climate change demonstrate the crucial need for establishing historical baselines for mammal communities. Use of natural history museum collections to achieve this end is well documented; however, natural specimens and associated data must be properly cared for and accessible to researchers for their value to be realized. A portion of the University of Illinois Museum of Natural History collection was donated to the Museum of Southwestern Biology in 2005. It included 32,745 specimens from New Mexico, Arizona, Texas, California, Alaska, and South America. Represented are 11 orders, 108 genera, and 254 species that span a hundred year range concentrated mainly between 1950-1980. This important collection is the basis for Hoffmeister's \textit{Mammals of Arizona} and contains 7 holotype specimens from the Southwestern U.S., as well as critical specimens of endangered taxa (e.g. 29 specimens of Mexican Grey Wolf, \textit{Canis lupus baileyi}). This collection is being geo-referenced and the associated data are available through the web-based, searchable MSB database (ARCTOS). Integration of this collection by MSB will enhance access and facilitate future research in areas such as systematics, biogeography, ecology, and epidemiology.
106: Archival observatory for endangered organisms: Mexican grey wolf (Canis lupus baileyi) summaries of contemporary research

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The Mexican grey wolf (Canis lupus baileyi) has suffered marked declines over the last century largely due to human persecution and eradication efforts. Few of these organisms were historically archived in museums. Consequently, much of the critical information regarding natural history, taxonomic affinities, and fundamental biology were poorly recorded and preserved. Contemporaneously, many more individuals have been wisely archived. We organized the archival materials available and have summarized the research over the past century involving these specimens. Further, we provide examples where appropriately archived material would have facilitated management goals, however, absence of such records precluded actions. We also provide research objectives and priorities for ongoing and future studies. Fundamentally, natural history records provide an essential division of information for conservation and management efforts of endangered and non-endangered organisms as exemplified by Mexican grey wolves as model organisms.

107: Modeling the effects of fire severity on moose population densities and implications for ecosystem services

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The importance of moose as a subsistence food to many Alaskans is indisputable. Impacts of a changing climate upon those resources are therefore of great concern for wildlife managers. Increasing global temperatures have been linked to increases in fire frequency and fire severity at northern latitudes where there is a related shifting toward a more deciduous dominated landscape. In contrast to previous models of boreal forest successional dynamics, this modeling project explores the link between fire severity and moose population responses. It examines the intricacies of response in non-predator-limited moose populations and the paradox that their rapid ability to respond to available forage puts these populations at greater risk of decline in years of extreme environmental events. The model simulates population dynamics of a moose population where fire severity and available browse inputs inform a matrix population model, and explores the interactions between browse production and consumption in response to fire severity, where a supposed linear function becomes non-linear due to the multiplicative effects of both a functional and numerical response.

108: Population assessment of golden mice in Illinois: Relative abundance and sympatric white-footed mice

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Golden mice (Ochrotomys nuttalli) are on the periphery of their range in Illinois where they are a state-listed species because of limited distribution and low population density. This project was initiated to assess relative abundance and distribution of O. nuttalli in Illinois in comparison with populations throughout the core of their geographic range. We live trapped at 24 sites; each site (7 x 7 grids) was sampled twice for 5-day periods from April-October 2008. Golden mice were trapped on 21 of the sites (mean = 4.13 individuals; range 0-15). White-footed mice (Peromyscus leucopus) occurred on all sites
We expected an inverse relationship in abundance between the two species because of interspecific competition. However, there was a significant positive relationship considering new animals for each sample period ($F = 16.32$, $df = 46$, $P < 0.0002$) as well as minimum number known alive ($F = 8.69$, $df = 46$, $P < 0.005$). Positive relationships may have resulted from sampling bias that favored golden mice because traps were placed above ground as often as possible. From May through October 2009, 24 sites throughout the southeast U.S will be sampled as in Illinois.

**109: Investigating the potential impacts of shrub encroachment on arctic ground squirrel (Spermophilus parryii) behavior and density**

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Recent climatic warming has lead to widespread shrub encroachment in to alpine and arctic tundra. This could result in a decrease in visual openness of current tundra habitats. Many alpine mammals rely on vigilance for predator detection. An increase in shrub density and resulting decrease in the ability to detect predators at distance could therefore have serious negative consequences for these populations. This could be a result of either a direct increase in mortality via predation, or a reduction in foraging efficiency as a result of increased predator sensitive behavior.

Preliminary results show that arctic ground squirrels occur at greater density in alpine tundra than lower elevation shrub. Whether squirrels inhabiting more shrubby areas are more predator sensitive has been investigated using giving-up density experiments (GUDs). Survival and reproductive success may also be lower in shrubby areas, which could act as sinks.

Using this field data I will programme a stochastic dynamic programming model of habitat choice between shrub and tundra landscapes. This will be expanded to consider multiple individuals and then both current and future projections of shrub and tundra landscape configurations. This will ultimately allow for better projections regarding the impact of shrub encroachmet on arctic ground squirrel populations.

**110: Age dimorphism of pelves of Sorex sonomae (Soricomorpha: Soricidae)**

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Bones of shrews (Soricomorpha: Soricidae) in regurgitated owl pellets and fossil matrix commonly include pelves. Researchers interested in ecology of fossil or extant communities of mammals, would find it useful to identify sex and age of individuals from pelves. To determine if sex, age, or subspecific designation of shrews could be distinguished or determined by their pelves, 76 females and 145 males were examined. Pelves of subspecies of Sorex sonomae are indistinguishable by analyses of morphometric data or geomorphometrics. Although size and shape of pelves among males in age classes 3--4 vary considerably, they form a coherent group completely distinguishable from males in other age classes and all females. Pelves of males within age classes 1--2 and those of all females are indistinguishable based on size or shape. Time of year collected and cohort of individuals had no impact on ability to distinguish sex or among age classes based on pelves. All males in age classes 3--4 had enlarged testes, thus these males were presumed to be reproductively active. The wide range of robustness of pelves of these males could be an indication of individuals belonging to different behavioral components within their populations. Perhaps larger pelves are from more-dominant individuals.
111: Rising above the conflict: Meadow jumping mice coexist with meadow voles through vertical habitat partitioning

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Meadow jumping mice (Zapus hudsonius) are widespread but rare in northern North America. Boonstra and Hoyle (1986) hypothesized that Zapus populations are perennially low due to suppressive effects of competitively more dominant Microtus. We sought to determine if Zapus occupy distinct microhabitats where they co-occur with Microtus. We used live trapping and powder-tracking to assess use of space in the horizontal and vertical dimensions. We found no evidence of spatial partitioning but clear evidence that Zapus were seldom moving at ground level where Microtus confine the majority of their activity. Mean trail length was 56.4 m for the 30 Zapus that were powder tracked over the two year study period. No difference in trail height was found between females and males or between study years. Overall Zapus trail height averaged 5.98 ± 1.32 cm (S.D.). We observed Zapus trails occasionally in the highest portions of standing vegetation. We found that Zapus moved less frequently over moss and ground than expected based on its availability. Additionally, Zapus appeared to specifically avoid Microtus trails. We conclude that Zapus are able to co-exist with Microtus as a result of this vertical habitat partitioning.

112: Behavioral ecology and birth control of introduced eastern fox squirrels in California

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Eastern fox squirrels are a nonnative species in California whose range is rapidly expanding, especially in urban and suburban areas. These populations harm plants and trees, chew on electrical wires, and become aggressive towards people. Traditional means of population control, such as removing trees or poisoning, are either unrealistic or socially unacceptable. Birth control through immunocontraceptive vaccines may offer an alternative means of population management by reducing the reproductive capability of male and female squirrels. We are testing the efficacy and behavioral effects of this method on eastern fox squirrels at the University of California, Davis (UCD) campus. The first phase of this project being presented here establishes baseline information on the behavior and basic ecology of fox squirrels in California from November 2008-May 2009. At two study sites on the UCD campus, 156 squirrels were trapped and marked with fur dye for individual identification. Behavioral observations were conducted to determine the daily activity patterns of the fox squirrels and the hierarchical social system. Individual's roles as either the dominant or submissive individual in aggressive interactions were used to determine the social rank of each individual in the population. The immunocontraceptive vaccine will be administered in July 2009.

113: Fecal indices in mule deer during winter: Effects of competition with elk

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We measured nitrogen and glucocorticoid metabolites in feces from mule deer (Odocoileus hemionus) at Tex Creek Wildlife Management Area near Idaho Falls, Idaho, during winters 2007 and 2008. We used
location data derived from GPS collared elk (*Cervus elaphus*) and kernel techniques to build elk density maps for each month (January-April) for both winters. Fecal nitrogen among deer was higher in 2007 (mild winter) than in 2008 (severe winter). There was no relationship between fecal nitrogen among deer and elk density. In 2007, the mild winter, there was a significant positive relationship between elk population density and glucocorticoid levels, indicating increased stress among mule deer wintering in close proximity to elk. During the severe winter in 2008, mule deer and elk were crowded together on south-facing slopes. Contrary to predictions, glucocorticoid levels in deer were lower in 2008 than in 2007, and showed no significant relationship with elk density. High glucocorticoids in blood plasma are associated with increased catabolism of body fat and muscle mass. We hypothesize that lower glucocorticoid levels in 2008, despite a more severe winter and higher localized elk densities, represented an adaptive process which served to maintain body condition during a period of higher nutritional stress.

114: Differentiation of the broad-clawed shrews (Soricomorpha, Soricidae), *Cryptotis griseoventris* and *C. goodwini*, using skeletal morphology of the fore foot

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Five species of broad-clawed shrews (*Cryptotis goldmani* group) occur in Mexico and Central America. Two of these species, *Cryptotis griseoventris* and *Cryptotis goodwini*, occur in close proximity in southeastern Mexico and Guatemala. Previously, the difference in size, particularly of the skull, was used to distinguish populations of the larger *C. goodwini* from the smaller *C. griseoventris*. However, individual specimens are more difficult to identify using skull size alone because of some overlap in size between the two species. Some differences have been identified in the post-cranial skeleton, but most older specimens of these two species are represented by traditional skins and skulls. Fortunately, most dried skins prepared for museum collections retain the fore foot skeleton. We investigated our ability to distinguish these two species from the skeletal morphology of their fore feet, using a digital x-ray system to obtain images of the bones of the fore feet from dried skins. In most cases, we were able to differentiate individuals of *C. griseoventris* from those *C. goodwini*, and we were able to distinguish one other population, as well.

115: The nature and significance of fossil and modern food-caches of the arctic ground squirrel (*Spermophilus parryii*)

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A suite of information about the ecology, physiology, evolution, and environment of modern and fossil mammals can be gained by examining the contents and ecological significance of recent and preserved food caches of subterranean rodents. Ancient caches formed by arctic ground squirrels (*Spermophilus parryii*; ags) have been used to infer vegetation and foraging ecology of Alaska and Yukon’s steppe-tundra biome during the Pleistocene. Analysis of modern caches coupled with local vegetation surveys can provide a calibration for paleo-interpretations and determine foraging preferences of ags based on available plant type and abundance, nutritional content, and distribution. Because caches are consumed by male ground squirrels after an ~8 month heterothermic period, the energy and nutritional
content of the food cache should give insight into unique replenishment requirements for post hibernation phases in mammals. In addition, reproductive maturation and mating success of males in spring is likely dependent on the success of gathering and defending a food cache the previous fall. We are testing this hypothesis by offering cacheable and non-cacheable diets during late summer to captive animals hibernating in outdoor enclosures in Fairbanks, Alaska and assessing their reproductive condition in spring. Study design and results from this experiment will be reported.

116: Hybridization between *Neotoma fuscipes* and *Neotoma macrotis* in isolated populations of the Central Valley of California

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Woodrats of the *Neotoma fuscipes-macrotis* complex were likely once widely distributed in the Central Valley of California but are now restricted to a small number of remnant riparian forest patches. Based on mitochondrial DNA evidence, the western and eastern flanks of the San Joaquin Valley (southern Central Valley) are occupied by *Neotoma fuscipes* and *Neotoma macrotis*, respectively. As such, it is unclear which species would have dominated a more hospitable San Joaquin Valley or whether both species co-existed across the region. Furthermore, given recent evidence that these species have the capacity to hybridize, isolated populations may retain evidence of past hybridization and/or be sites of ongoing genetic exchange. Here, we present both mitochondrial sequence and nuclear microsatellite data to refine our understanding of the history of these taxa across this region. Of the 103 woodrats examined from 3 localities, all samples clustered within mitochondrial clades previously associated with either *N. fuscipes* or *N. macrotis*, although both mitochondrial clades were found in each of the 3 sites. Nuclear microsatellite data revealed three genetic clusters that were largely geographically consistent with 1 cluster per sampling location. Discordance between mitochondrial and nuclear loci suggest a complex history of hybridization between these species.

117: Effect of prescribed burns on East-African savanna small mammals

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In the Laikipia Plateau of central Kenya, murid rodent community of black-cotton vertisol grasslands is usually limited to *Saccostomus* and *Mus* spp. In red soils, *Tatera*, *Acomys*, *Aethomys* and *Mastomys* spp. are common co-dominants. In 2006 and 2008, natural small-mammal densities in a variety of sites in both habitats were < 10/ha, but inside large-herbivore exclosures, densities were several-fold higher and species richness doubled. Rodents whose natural refugia were red soils appeared in black-soil exclosures, and vice versa. The diurnal grazer *Arvicanthis* was common only inside exclosures. Across both habitats in 2006, there was a strong positive effect of grass height and moribund-stem density on small-mammal density. This suggests depleted abundance and diversity of murid rodents resulting from overgrazing and/or long-term fire exclusion. Live trapping of prescribed burns (burn pixels 1 ha and 9 ha) and adjacent unburned controls in black cotton 18-55 months post-burn showed maintenance of taller grass, higher dead-stem density, and higher abundance of small mammals on unburned pixels. In this limited experimental landscape, continued avoidance by predation-risk-averse small mammals of burned patches into the medium term may be perpetuated by cropping by native and domestic grazers in a positive feedback cycle of grazing and nutrient enrichment.
118: Modeling occupancy for American mink in human-dominated landscapes

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Reliable occupancy data are a prerequisite for understanding constraints to the spatial distributions of species and for predicting responses to land-use changes. Quantifying species occurrence for elusive carnivores can be challenging. We evaluated two methods for estimating site occupancy for American mink (*Neovison vison*) based on sign in riparian ecosystems. Walking surveys had a higher per-visit detection rate (0.72, SE = 0.03) compared to mink rafts (0.40, SE = 0.06), which were developed in the UK where the mink is an invasive species. Detectability from walking surveys was influenced by three covariates: observer, recent rainfall, and date. We combined walking survey data for two years from 90 stream segments with maximum likelihood approaches that deal with imperfect detection to model occupancy and spatial dynamics of mink. Site occupancy increased from 0.45 (SE = 0.07) in 2007 to 0.93 (SE = 0.03) in 2008. Occupancy was related positively to water depth and vegetation cover and negatively to urbanization levels. Colonization was positively related to stream size and riparian width. These responses represented habitat use and resource tracking by individuals. The spatial distribution of mink was related to local and landscape covariates, dynamic over time, and relatively unconstrained during a wet year.

119: *Hipposideros commersoni*, a Malagasy endemic: Sleeping beauty or seasonal migrant?

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Recent molecular work on the bat fauna of Madagascar has revealed a number of new cryptic species. *Hipposideros commersoni* from three distinct zones on the island show morphological variation. These differences correlate with ecological variation in vegetational and climatic regimes in the southern sites versus the northern sites, and a concurrent latitudinal shift from dry deciduous forest in the north to spiny bush in the south. Additional factors are significant. First, the populations in the south may be under threat as they are harvested at unsustainable levels. Second, local people report that southern bats disappear for six months of the year. Using molecular techniques, we examine the question of whether *Hipposideros commersoni* on Madagascar is one, at least partially migrating, interbreeding population.

120: Survival of North American elk: Costs of reproduction

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Reproduction in large mammals is costly; energy demands throughout gestation and lactation are high. Factors shown to be linked with reproductive status are physical condition, age and previous reproductive effort. We used 8 years of recapture information from a captive elk population to examine costs of reproduction and test the hypothesis that reproductive effort in one year will affect survival probabilities and reproductive status the next. Multistate models in program Mark were used to generate estimates for transition probability and survival conditioned on whether an individual was pregnant or not pregnant the year prior. The most parsimonious model included effects of age class, and reproductive status on survival, and effects of age class and reproductive status on transition probabilities. Pregnant adult females had a significantly higher survival probability than non-pregnant adults (0.893SE=0.01; 0.811SE=0.03), however they had a lower probability of becoming pregnant the following year (0.718SE=0.02; 0.79SE=0.03). This may be a result of pregnant females being in better
condition during the fall, when compared to non-pregnant females of the same year. However, the high energy requirements necessary to rear young become apparent in the reduced probability of becoming pregnant the subsequent year, when compared to non-pregnant females.

121: Life in the big city: Woodchuck movements and behavior across an urbanization gradient

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Urbanization is increasing at a rapid rate and we need a better understanding of how wildlife populations are being impacted. Woodchucks (*Marmota monax*) are thought to be “urban adapters”, yet little information exists on the underlying mechanisms for this response. We examined movements, anti-predator behavior, and habituation to humans of adult woodchucks distributed across an urban-rural gradient in central Illinois by tracking and observing individuals (n = 39) over two active seasons with surgically-implanted radio transmitters. We expected urban woodchucks would have smaller home ranges, spend less time vigilant, and become more habituated to humans than rural woodchucks. Male home-range size was larger than that of females, and home-range size was related negatively to urbanization. Vigilance behavior did not vary with urbanization, however woodchucks became more habituated to humans in highly urbanized areas. These results demonstrate the ability of woodchucks to exhibit substantial behavioral plasticity in response to urbanization pressures. Ongoing research is examining how these behavioral adjustments might relate to variation in survival rates across the urbanization gradient.

122: Home range size of the southeastern beach mouse (*Peromyscus polionotus niveiventris*) on the Kennedy Space Center

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The southeastern beach mouse (*Peromyscus polionotus niveiventris*) is one of seven subspecies of the old-field mouse that reside in the coastal ecosystems of Florida and Alabama. The Kennedy Space Center and surrounding federal lands are the last stronghold for this subspecies whose range has declined by 79%. While demography and population estimation data have been collected for this threatened mouse, homorange sizes have never been determined. Forty five beach mice (24 males and 21 females) were fitted with a BD-2NC radiocollar from Holohil Systems Ltd. Fifteen mice were tracked in Summer 2008, 10 in Fall 2008, 10 in Winter 2008, and 10 in Spring of 2009. Of the 25 beach mice tracked, only two were lost during the tracking period. Homorange size was determined using minimum convex polygon methodology. Homorange sizes for males ranged from 151m$^2$ - 862m$^2$, 554m$^2$ - 1169m$^2$, and 241m$^2$ - 1130m$^2$ in Summer, Fall, and Winter, respectively. Homorange Sizes for females ranged from 418m$^2$ - 3510m$^2$, 790m$^2$ - 3373m$^2$, and 236m$^2$ - 2254m$^2$ in Summer, Fall, and Winter, respectively.

123: A long term ecological study of small mammals in central Pennsylvania: Three years later

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To protect, conserve and manage a habitat and everything that is contained within, one must first know
the organisms (a list of organisms will be derived from this general survey) and then their ecological characteristics (derived from long term studies). One hundred and ninety eight (Havahard, Sherman and Ugland) traps were set up at five sites in two different locations during summer and winter for three years (2006-2008), totaling five trapping seasons. For all the sites a combined 499 captures, 14 species, were caught with a trap effort of 4,164 trap nights. There was an overall trap success rate of 11.9%. Both Peromyscus species seem to be the most abundant species at all the locations with higher numbers in locations with greater foliage cover depending on the season. The benefit of following small mammal populations for long periods of time become obvious when after almost three years of trapping and working on our data, population patterns start to emerge. We can even see the value of our results and their implementation into local land management projects.

124: "Treated" vs. new traps: Does chronic application of disinfectant to traps reduce rodent catchability?

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Recognition of the presence of hantavirus in rodents has led many Institutional Animal Care and Use Committees to require decontamination of live traps that have captured small mammals. In March-April 2007, we examined whether trap exposure to disinfectant would reduce the trappability of rodents as compared to new traps, as part of an ongoing long-term study of small mammals conducted at the Konza Prairie Biological Station (located in the tallgrass prairie ecosystem in northeastern Kansas). We tested (1) whether rodents made an initial choice between treated (disinfected) traps and new traps and (2) if total captures differed between these two trap types. In fact, disinfectant treatment did not reduce the catchability of traps, and—when directly compared to new traps in their initial days in the environment—treated traps actually were preferred. In pairwise choice comparisons, rodents chose significantly more treated traps than new traps, although this difference did disappear as the new traps aged in the environment. The predominant prairie species, the deer mouse Peromyscus maniculatus, was the only individual species that showed this significant temporal pattern. Neither total captures of small mammals nor those of deer mice showed a significant difference between treated and new traps.

125: Effect of roads on movement of Peromyscus leucopus: Field activity for a general ecology class

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Effective field activities for a general ecology class involving mammals are challenging to develop. In this poster we present 14 years of data from an experiment on the effect of roads on the movement of Peromyscus leucopus that has been used in the General Ecology class at the University of New Hampshire Manchester. We set two trap lines 10 m apart on either side of a road. Two live-traps were placed at each of eight trap stations at 10 m intervals along each trap line. A second set of trap lines was set up in similar habitat without a road. We live-trapped for two weeks, marked all captures with an individually numbered ear tag, and recorded species, location, weight, and reproductive condition. Location of recaptured individuals was compared to their previous capture location. Seven species of small mammals (394 individuals) were captured. P. leucopus trapped per year ranged from 2 to 40. By the road 12.2 % of recaptures and 23.2 % of individual mice moved across the road, while in the woods 33.1% of recaptures and 41.2% of individual mice moved between trap lines. We conclude that the road
inhibited movement, but did not act as a complete barrier.

126: **Annual fires and the deer mouse in tallgrass prairie: A 25-year study**

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Deer mice (*Peromyscus maniculatus*) increase in abundance following spring fire in tallgrass prairie and other grassland ecosystems. Although this pattern is well known, nothing is understood about effects of long-term annual spring burning on abundance of deer mice, or the attributes of deer mice that inhabit annually burned grassland sites. To investigate the effect of long-term annual burning in spring, we examined patterns of abundance and life history traits of deer mice in two treatments (001D and N01B) on Konza Prairie Biological Station over a 25-year period (autumn 1981-spring 2006). We trapped small mammals on 2 traplines in each treatment for 4 consecutive nights in autumn and spring as well as summer (1982-1987). We captured a total of 1,331 deer mice; more mice were captured on N01B (860) than on 001D (471). Relative abundances varied from 6.1 to 9.3 mice per trapline on N01B, whereas the range was from 2.0 to 6.0 on 001D. What factors, intrinsic or extrinsic, caused this amount of variation? No simple relationships were found related to precipitation, temperature, and plant productivity. Age structure, reproductive activity, and turnover rates varied from year to year and were far from constant.

127: **Geographic variation and genetic structure in the broad-nosed bat genus *Platyrrhinus* (Chiroptera: Phyllostomidae)**

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The Neotropical bat genus *Platyrrhinus* is one of the most speciose genera; it currently includes 20 species. The broad Neotropical distribution of *Platyrrhinus* and its radiation into most areas of endemism makes it an excellent group for exploring phylogeography. Here we present the comparison of two mitochondrial markers, Cytochrome-\(b\) and D-loop, in population of eight *Platyrrhinus* species across its geographical range. We sequenced approximately 1550 bp in 238 individuals. The data were used to investigate the geographic variation and genetic structure. We found 185 haplotypes from the 238 individuals in the concatenated Cyt-\(b\) + D-loop. Haplotype network, Mantel Test and analyses of molecular variance (AMOVA) found no geographic structure in seven species, *P. brachycephalus*, *P. helleri*, *P. incarum*, *P. lineatus*, *P. matapalensis*, *P. sp. nov. A*, and *P. sp. nov. B*, whereas only *P. recifinus* showed geographic structure, in which haplotypes from Guyana and Suriname were separated from Brazilian haplotypes. The smaller values of F\(_{ST}\) observed in the seven species with no geographic structure may derive from greater gene flow between populations of these species, whereas the high F\(_{ST}\) value observed for *P. recifinus* suggest little to no gene flow between the Brazilian population and populations from Guyana and Suriname.

128: **Ecology of small mammals with implications for wetland conservation and restoration**

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Restoration and conservation of wetland areas is a pressing concern with the spread of urbanization, and reclamation of abandoned wetlands is becoming more important as natural areas disappear. The key to success is understanding the working components and interactions in these ecological systems. The importance of small mammal species in wetland ecosystems has been undervalued in restoration, notably in individual species differences regarding seed predation, seed dispersion, and availability as prey. Using small mammals as an ecological indicator of condition, this study aims to evaluate restoration of wetlands and analyze natural wetland communities in the New Jersey Pinelands. The study will compare diversity, population size, and diet differences among post-agricultural cranberry bogs of varying hydrology that have undergone turnover modification to promote natural succession, sites maintained without intense modification, and natural wetland sites. Current data show that post-agricultural bogs are dominated by meadow voles (*Microtus pennsylvanicus*), while dry conditions promote white-footed mice (*Peromyscus leucopus*). Data regarding turnover modification is preliminary, yet shows a trend toward general species decline. Other wetland sites in the area have been shown to harbor much greater species complexity. Live-trapping efforts show that community structure changes seasonally and adjacent natural wetlands do allow for immigration opportunity.

129: Seasons of change in Washington, DC: The experiences of the 2008 ASM-AIBS Public Policy Intern

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From September 2008 until February 2009, I represented the American Society of Mammalogists (ASM) at the American Institute of Biological Sciences's (AIBS) Public Policy Office in downtown Washington, DC. This experience was made available to me through the ASM-AIBS Graduate Student Public Policy Internship. This award was funded by ASM with an extension funded by AIBS. The internship enabled me to be a part of history as I resided in our nation's capitol during the election and inauguration of President Barack Obama as well as at a time of tremendous economic turmoil. The activities that I participated in while at AIBS included attending hearings on Capitol Hill, writing items for the Public Policy Report, authoring the December 2008 Bioscience Washington Watch, updating the Federal Register Resource maintained by AIBS, helping compile and report the results of a National Science Collections Alliance survey, constructing a one-pager advocating for funding of mammal research, and other assorted public policy research. Hot science policy issues during this time frame included emerging contaminants in water, regulation of greenhouse gases under the Clean Air Act, the Bush Administration's Endangered Species Act (ESA) modifications, and the role of science funding in the economic stimulus legislation.

130: Diversity of mitochondrial haplotypes on a naturally isolated population of moose on Isle Royale

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Genetic variation is positively associated with a population's ability to adapt to a changing environment and is therefore important to a population's persistence. Isolated and small populations experience greater loss of genetic variation and increased inbreeding due to reduced interpopulation dispersal. Inbred populations have shown decreased longevity, reduced juvenile survival and are at risk for extinction through stochastic event. My project assessed genetic evidence of isolation in the Isle Royale moose population. Isle Royale is a small, island located 24km off the southern coast of Canada, which
was colonized by moose in the early 1900’s. The first population census reported approximately 200
moose in 1915. Using moose carcasses collected and stored by Michigan Technological University
from 1960-1965 and 2000-2005, I extracted and sequenced DNA at the left hyper-variable domain of the
control region of 20 moose. Sequencing produced mitochondrial lineages allowing the assessment of
changes in inbreeding over time. Preliminary analysis shows little variation at the hyper variable control
region. Comparison of Isle Royale moose lineages to lineages from across North America will help
clarify if genetic variation was lost prior to the moose founding event on Isle Royale or if low genetic
variation is a result of isolation.

131: Mammalogy, ornithology, botany, and the public: Expanding science and natural
history education in Historic Bethabara Park

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Historic Bethabara Park is a 183-acre historic site and wildlife preserve in Winston Salem, NC. Due to
its human history as the first Moravian settlement in NC records of biota and land use are available from
1773 to the present. Since 2005, the natural history program has been developed to include interpretive
signage, slide shows, and a grant funded, Park-specific Field Guide published by Waterford Press Inc. in
2008. The Field Guide effort was a response to an increasing demand for information about the natural
world. This Field Guide has provided us with the opportunity to inform the public about common flora
and fauna, especially mammals that they rarely see. Mammals were regularly documented by the settlers
and now help us tell the story of habitat changes; examples include the extirpation of black bears and the
persistence of southern flying squirrels. In collaboration with the Audubon Society of Forsyth County
ongoing projects involve the community through bird surveys, organismal (mammal, herp etc.) and
habitat specific workshops, and other outreach activities. At this time benefits of these outreach efforts
are qualitative as good assessment techniques for long term impacts of this type of informal education
are rare.

132: Arboreal habitat structure affects locomotor performance of white-footed mice (Peromyscus leucopus)

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Although the effects of branch structure on the locomotion of arboreal lizards are well known, similar
empirical data are lacking for small mammals. Thus, for the semi-arboreal rodent, Peromyscus leucopus,
we conducted laboratory trials to determine whether its locomotion was affected either by the inclines
(0°, +45°, -45°) or the diameters (0.6, 1.3, 2.5, 5.1, and 10.2 cm) of cylindrical surfaces. Running
speeds changed significantly with diameter and incline. For a given diameter, running horizontally was
usually faster than running either uphill or downhill. The fastest (1.44 m/s) and slowest (0.87 m/s) mean
speeds occurred on the horizontal 2.5 cm diameter surface and the downhill slope with a diameter of
10.2 cm, respectively. For running horizontally, the slowest mean speed was on the smallest diameter
(1.18 m/s), but speed differed little among the three largest diameters. In contrast to running on the
horizontal surfaces, the speeds for both uphill and downhill running usually decreased with increased
diameter of the three largest cylinders. These interactive effects of surface diameter and incline may
arise from variation in the tendency to topple, the ability to grip and the ability to align the feet optimally
with the substratum.
133: Importance of incorporating genetic diversity in mammalian surveys: A case study from Botswana's Koanaka Hills

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Definitions of biodiversity often include assessments of diversity at multiple levels, including species, genetic, and ecosystem diversity. However, most modern surveys tend to focus on species-level diversity, often ignoring genetic and ecosystem diversity of a region. In order to provide a more detailed assessment of the mammalian biodiversity of the Koanaka (Nqcumtsa) Hills, Botswana, we sequenced the first 400 base pairs of the cytochrome-b gene from a subset of small mammals collected in June 2008. Although genetic data for the Southern Subregion of Africa is underrepresented for many small mammals, we were able to combine our Cyt-b sequences with published sequences of Cyt-b for a subset of taxa known to contain cryptic species (e.g. *Aethomys*, *Micealamys*, *Mastomys*) or morphologically similar species (e.g. *Gerbilliscus*, *Mus*). Although some taxa were genetically similar to South African specimens (e.g. *Mus*, *Mastomys*, *Elephantulus*), others were highly divergent (e.g. *Gerbilliscus* and *Micealamys*) with sequence divergence values from 5.5 - 10.6%. In addition, several rodent species were more phylogenetically similar to species whose current distributional ranges lie outside Botswana (e.g. *Aethomys* and *Mus*). Preliminary results indicate the importance of using genetic data in biological inventories and the need for increased sampling of rodents in Africa's Southern Subregion.

134: Feeding behavior of laboratory reared *Onychomys leucogaster* (northern grasshopper mice) when offered live food

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*Onychomys leucogaster*, Northern Grasshopper mice, are unique among rodents in that they are largely carnivorous in the wild. These carnivorous predilections are well documented in the literature for wild populations and somewhat documented in the laboratory. The purpose of this study is to examine the feeding behaviors in animals that have been 2-4 generations removed from the wild. It is hypothesized that their reaction to live food will be similar to that of wild specimens. Further it is hypothesized that the animals will prefer more mobile crickets versus more stationary mealworms. Recognition of naturalistic behaviors observed in laboratory raised animals will validate their use for further feeding and behavioral studies. The study design has a single animal housed in a semi-naturalistic enclosure of roughly 2'x4'. Live food items are introduced in addition to standard lab chow and behaviors observed. Preliminary data indicate that regardless of the number of generations out of the wild naturalistic hunting and feeding behaviors are observed. Food item preference between crickets and mealworms is thus far not conclusive. A statistical comparison will be presented.

135: Pocket mouse invasion influences desert plant community structure in place of absent kangaroo rats

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Predators have the ability to influence community dynamics of their prey. Recent research shows that altering dispersal of predators into habitat patches alters prey beta diversity among sites. This can result from the dual ability of predators to influence stochastic and deterministic processes affecting prey community structure. Experimental manipulations at a long-term research site, the Portal LTREB,
provide a natural study system comprised of desert rodent predators and plant prey to study predator-driven structuring processes. Portal plots represent three treatment categories: 1) all rodents have access, 2) large-bodied rodents (*Dipodomys* spp.) removed, and 3) all rodents removed. Comparisons of winter and summer annual plant community beta diversity among plots explore the effects of predators on prey diversity in a natural system. Large-bodied species at the site have a greater impact on plant community structure than small-bodied species, especially in the winter annual community. However, the effects of a recent invasion by a large-bodied species, *Chaetodipus baileyi*, into *Dipodomys* removal plots on plant community structure remains poorly understood. If *C. baileyi* is compensating for missing *Dipodomys* spp., then plant community structure post-invasion may resemble control plots. Empirical work in multi-trophic, open systems is essential to understanding community diversity in dynamic systems.

136: *Seasonal home ranges and movement patterns of an Iowa species of greatest conservation need*

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The loss and fragmentation of Iowa's native landscape has isolated populations of native fauna, having varied effects on different species as some move more easily through unsuitable habitat to reach fitting environments. Small mammals may be highly affected by isolation as they may not easily move among habitat patches. I am studying the white-tailed jackrabbit as a representative of Iowa's grassland-adapted species to determine effects of habitat fragmentation on movement patterns, space use and genetic diversity. I tracked radio-collared jackrabbits beginning in September 2008 on random days, at random times to determine habitat use in an intensively agricultural landscape. Before row-crop harvest (September-October 2008), female home ranges showed greater overlap than those of males, which had larger ranges and moved farther than females. Home ranges of both sexes expanded and shifted following row-crop harvest and prior to the beginning of breeding season in February. Tracking and genetic assessment of diversity and connectivity of Iowa populations will continue into fall 2009.

137: *Morphological and molecular analysis of populations of Oreoryzomys balneator*

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Rice rats of the tribe Oryzomyini present a number of difficult taxonomic problems. In an effort to further discern cryptic species level variation, we studied populations of Ecuadorian *Oreoryzomys balneator*. Fifty-five specimens were collected during a survey of the Cosanga River Valley. Cytochrome *b* was analyzed on a subset of our sample. It was found that the samples from the Cosanga Valley were 7% divergent from those taken from Peru and therefore warrant species level status. Our samples were compared with the morphologically similar *Microryzomys*. The Microryzomys were found to be 15% divergent from the Cosanga samples. After finding significant genetic divergence between our specimens and other known samples of *Oreoryzomys* and *Microryzomys*, a morphological comparison was made between our samples and known *O. balneator* specimens from Ecuador and Columbia. Finally, a statistical comparison using skull morphometric features was made through multivariate analysis of variance revealing further differences between our specimens and other populations of *O. balneator*. 
138: Effects of landscape alteration on the distribution of *Neotoma micropus*

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The introduction of human presence in an area results in alterations in the landscape including the loss of habitat and fragmentation of the habitat that remains. Variability in response to landscape alteration has been demonstrated in several studies and the results of the studies have shown that dietary and habitat breadth are of primary importance where dietary and habitat generalists are more likely to persist in the face of landscape change than are specialists. In fact, some dietary generalists have been quite successful at adapting to the addition of anthropogenic food sources. We determined the distribution of houses of dietary generalist, *Neotoma micropus*, on a more-disturbed (MDS) and a relatively less-disturbed site (LDS). Houses on the MDS were located closer to disturbances than houses on the less-disturbed site. House density was greater on the LDS than on the MDS. Anthropogenic waste accumulated at a significantly higher rate on the MDS compared to the LDS. Results of our research suggest that *N. micropus* enhance their ability to access resources by placing houses close to anthropogenic disturbances.

139: Resource selection by mule deer on winter range: Effects of space use by elk

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Populations of mule deer (*Odocoileus hemionus*) have declined throughout western North America over the past 40 years, whereas populations of North American elk (*Cervus elaphus*) have increased. Consequently, understanding how and to what degree competition with elk affects mule deer populations is important for minimizing future declines. We modeled patterns of resource selection and space use by mule deer and elk on winter range at Tex Creek Wildlife Management Area near Idaho Falls, Idaho, USA, during Jan-Mar 2007 and Jan-Apr 2008 using conditional logistic regression. Modeling results differed significantly between species and years. During 2007 (mild winter), mule deer selected low elevations, steep slopes, and areas close to roads, and avoided areas used by elk. In contrast, during 2008 (severe winter) weather conditions forced populations of both species onto a smaller wintering area. As a result, spatial overlap of mule deer and elk increased substantially, and patterns of resource selection were similar between species. Our results indicate that mule deer on winter range avoid areas used by elk when possible, but that their ability to do so may be limited in some instances by weather conditions or other environmental factors that restrict the distributions of both species.

140: Molecular markers to evaluate the effectiveness of feral pig (*Sus scrofa*) damage control

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Biological invasions represent a serious challenge to managers. Feral pigs constitute one of the most
aggressive and dangerous invasive species because of their potential risk to native species, agricultural damage, and disease transmission risks. Traditional control methods for feral pigs include hunting, aerial shooting, poisoning, snaring, trapping, and fencing. Here we use a panel of genetic markers to assess the impact of control methods (trapping and aerial shooting) at 2 representative sites in southern Texas. We conducted 2 removals on one property (KC), and 3 removals on another property (WWR) and quantified population structure among the removal events at both sites (KC and WWR). We found that pigs before and after removal events in KC and WWR were genetically similar, suggesting that localized control at our level of intensity have minimal effect in controlling feral pig populations in southern Texas. Although the control efforts removed 3.4 pigs/km² over 20-32 km², we did not impact the local population, and the control areas were re-colonized within 6 mo. Our findings provide a new tool to assess control methods as well as emphasize the need for understanding how feral pigs use landscape features that facilitate movement and recolonization of available habitats.

141: *Ixodes scapularis* burdens of *Peromyscus leucopus* and tick infection by *Borrelia burgdorferi* in southwestern Maine

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Lyme disease (Lyme borreliosis) is the most common vector-borne disease in the United States. The etiologic agent, the spirochete *Borrelia burgdorferi*, is transmitted by the black-legged tick, *Ixodes scapularis*. In the Northeast tick larvae and nymphs obtain the spirochete when parasitizing infected vertebrates, principally the white-footed deer mouse, *Peromyscus leucopus*. Six deciduous forest sites in noncoastal southwestern Maine were sampled for the distribution and prevalence of *I. scapularis* from June through September 2008. Minimum infection rate (MIR) for ticks - the percentage of those harboring ≥ 3 spirochetes - was determined using a Direct Fluorescent Antibody test to detect *B. burgdorferi*. Fifty-five *P. leucopus* were captured 152 times over 3,535 trap nights among 7 trapping grids. Infestation rate (percentage of individuals infested) was 88%. Median tick burden (ticks per individual) for initial captures was 4 (range = 0-32); median tick burden for infested individuals was 4.5 (range = 1-32). Initial tick burden of males was significantly greater (*P* < 0.05) than that of females. MIR for 186 tick larvae was 22% and for 28 nymphs, 29%. Tick burdens and MIRs were considerable, suggesting the geographic spread of vectors and spirochetes inland from heavily infested coastal southern Maine.

142: Linkages between large-scale climate patterns and the dynamics of arctic ungulate populations

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Predation and winter range have dominated debates about caribou population dynamics. However, climate has direct and indirect impacts on caribou populations across the Arctic. Linkages between large-scale climate patterns and caribou populations have been documented in Norway, Greenland, and Canada. We posited that similar linkages exist in Alaska, so we analyzed population growth rates of caribou herds across arctic Alaska in relation to large-scale climate patterns, specifically the Arctic Oscillation (AO) and the Pacific Decadal Oscillation (PDO). We found that growth rates of all herds were significantly correlated with these patterns. Positive and negative correlations were identified
depending on climate pattern and region. Climate may have negative impacts of caribou populations through increased snow depths which impede movement and access to forage in winter. Either of these effects could affect predation rates. Under warming scenarios, increased frequency and spatial extent of icing events or reduced lichen biomass, a key winter forage, could also be detrimental to caribou. Warming may however lengthen the growing season and enhance the growth of vascular plants that are key summer forage species, benefiting caribou. We predict that other wildlife species population dynamics in Alaska and the northeastern Asia are also affected by large-scale climate patterns.

143: Boreal forests, land use, and white-tailed deer (Odocoileus virginianus) range expansion

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White-tailed deer (Odocoileus virginianus) have expanded their range into northern boreal habitats. In Alberta, Canada, population increase and expansion of white-tailed deer has already been linked to increased wolf abundance and elevated predation on threatened caribou populations. Northern ungulates face winter tradeoffs between minimizing energy expenditure and maximizing acquisition of potentially limited food resources. Hence, climate change, land use change, or both may facilitate range expansion through higher winter survival and reproduction. The purpose of this work was to determine the influence of agriculture, forestry and energy sector activities, independent of changing climate, on white-tailed deer range expansion in boreal Alberta, Canada. Aerial surveys were conducted at increasing distances from agricultural boundaries in the presence and absence of forestry operations. Aerial surveys and GIS analysis were also used to determine the spatial relationships between white-tailed deer, upland patches in a peatland mosaic, and linear features. Relative food abundance was compared between boreal habitat types and specific land use features. Results indicate that white-tailed deer can spread from agriculture and are aided by the presence of forestry operations. Also, linear features increase the presence of white-tailed deer in peatland dominated habitats. Mechanisms and interactions with climate change are discussed.

144: Size matters: Examining patterns of maximum body size of mammals over time and space

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Macroecologists often focus on body size because it is a proxy for many aspects of an organism’s biology. Size results from a complex and dynamic tradeoff between physiology, life history, environment, phylogenetic constraints, and past geologic and climatic history. Nonetheless, certain ‘invariant’ size-dependent relationships and broad-scale distributional patterns are repeatedly observed
for mammals. Do these arise because of common ancestry, similar environments, or because of similar
design or life history constraints? To examine these questions, we assembled a database of maximum
body size for the major orders found on each continent over their entire evolutionary history. Temporal
resolution was epoch or sub-epoch; data were collected from primary and secondary sources or
estimated from taxon-specific allometric regressions on fossil teeth or limbs. Overall, results clearly
demonstrate a rapid increase in the body size morphospace of mammals over the Cenozoic, reflecting
the evolutionary radiation after the extinction of dinosaurs at the K/T boundary. We find remarkable
consistency in the maximum size achieved over time on each continent, as well as that of various groups
of the same guild, although geologic factors influence distribution of orders among continents.
Interesting interchanges occur over time, with replacements by ecologically similar but phylogenetically
distinct orders.

145: Analyzing and visualizing the 4-dimensional relationships between terrestrial species
and environment

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Within the domain of terrestrial ecology lies the challenge of integrating and analyzing complex
spatiotemporal data sets in order to understand the dynamics of the system or individuals being studied.
Historically the various components of data integration have not been handled well within a single
software application. In particular the concept of a robust temporal analysis methodology, and capability,
has been poorly realized in most software tools despite an abundance of temporally referenced data. By
working closely with ecologists in the terrestrial sciences The Myriax Group has designed an advanced
geospatial analysis package specifically designed for the integration of such complex, 3D-spatial and
temporally dynamic datasets. The product, called Eonfusion, benefits scientists by significantly
decreasing the complexity of integrating and studying large volume data sets. It supports the goals of
resource management, conservation, and education by providing cutting edge tools for analysis and
visualization of information in both space and time. In the following we present real-world example
applications of Eonfusion.

146: Diversity gradients resulting from niche conservatism are a product of complex
interactions between climate and history

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Recently, historical explanations for contemporary patterns of diversity have complimented classical
explanations stressing environmental determinants of patterns of species richness along environmental
gradients. In the forefront is the concept of tropical niche conservatism whereby most higher taxa were
of tropical origin and limitations on species distributions determined by environmental gradients, in
particular seasonality, slow super-tropical diversification. Such a pattern of diversification operating
through millennia is proposed to create gradients in phylogenetic characteristics of species and
ultimately latitudinal gradients in diversity. It has recently been pointed out that patterns of
phylogenetic signal alone are not sufficient to indicate operation of niche conservatism. Indeed, even
slight random movements of daughter taxa away from the place of origin of ancestral taxa can create
spatial gradients in phylogenetic characteristics. Accordingly, if niche conservatism contributes to
latitudinal diversity gradients then environment should account more for phylogenetic characteristics
than models of spatial diffusion. My test involved 30 phyllostomid assemblages. Environmental
descriptors accounted more for phylogenetic characteristics than spatial descriptors implicating the role of tropical niche conservatism. Temperature accounted for more than precipitation and seasonality of temperature accounted for more than its magnitude. Historical effects of environmental conditions through millennia have created strong gradients in contemporary diversity.

147: Using niche-based modeling to determine if small mammals inhabit novel climatic conditions in northwestern Venezuela

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After isolation, disjunct populations may evolve different climatic tolerances. We address this possibility in three species of rodents (Heteromys anomalus, Rhipidomys venezuelae, and Proechimys guairae) on the Península de Paraguaná, which is connected to mainland South America by a narrow isthmus of sand. We calibrated maximum entropy (Maxent) models of the species' potential geographic distributions using occurrence records and climatic data from the mainland. We then determined whether each model predicted records of the species (or a close relative) on the Peninsula. To reduce overfitting due to sampling bias, we filtered mainland records so that all were separated by at least 10 km. We determined optimal settings (feature class and regularization value) for the models based on their ability to predict records from the mainland that were set aside for evaluation (based on AUC and omission rate). Final models were then run using optimal settings and all filtered records from the mainland. Depending on the species, all or most records from the Peninsula were predicted by the final models. These results indicate only low to moderate evolution of climatic tolerances in these taxa.

148: Influence of roads on home range and movements of urban coyotes

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Roads often serve as obstacles to movements of various terrestrial wildlife species, especially in urbanized landscapes. Knowledge of how species respond to different types of roads and traffic volumes has important conservation implications in urban systems, as roads typically fragment habitat fragments. We monitored movements of coyotes with respect to roads in the Chicago metropolitan area, a landscape with tremendous variations in road types and traffic volumes. Roads are an important aspect of the urban ecology of coyotes in this area with vehicle collisions accounting for approximately 50-70% of annual mortalities. We calculated 179 annual 95% MCP home ranges for 156 coyotes and created a buffered area surrounding each home range. We compared the densities of 5 road classifications, including freeways, highways, major-roads, minor-roads, and residential roads within home ranges and those within buffers. Buffered areas had significantly higher densities of all road types compared to road densities within home ranges except for minor-roads, which had a significantly higher density within the home ranges than in the buffered areas. Our results suggest that one key to the success of coyotes in urbanized areas is they establish and maintain home ranges that reduce their exposure to roads.
149: Estimating historical demography in the banner-tailed kangaroo rat (*Dipodomys spectabilis*) (Undergraduate Student Research Award)

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Genetic diversity is a key factor in the long-term viability of natural populations, and contemporary levels are shaped by the past effective population size (*Nₑ*). I investigated the past demography of an ecologically important grassland rodent, the banner-tailed kangaroo rat (*Dipodomys spectabilis*). The population trends of this species have been extremely well studied in the past 25 years at two populations near Portal, Arizona. Despite large size fluctuations and severe bottlenecks, genetic diversity (measured by neutral genetic markers) has been maintained at a high level in both populations. What, then, are the long-term demographic histories of these two populations, and are they concordant with one another? Major expansions and reductions leave a genetic signature that can be inferred through analysis of sequences of the control region of mitochondrial DNA (mtDNA) from a modern population. I found a moderate level of polymorphism and a loss of eleven haplotypes at one site following a severe bottleneck in 2004. Pairwise mismatch distribution shows that both populations have undergone recent expansions. This provides an example of how natural populations respond to *Nₑ* shifts and maintain genetic diversity over long timescales, despite short-term fluctuations, which is particularly important for efforts to conserve endangered species.

150: Assessing individual identification, relatedness, temporal and spatial structuring of brown bears in Katmai National Park and Preserve

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Katmai National Park and Preserve (KATM) supports one of the highest known densities of brown bears (*Ursus arctos*) in North America. The number of bears observed at Brooks River within KATM has increased substantially over the last 30 years. Spatial foraging patterns were observed with large male bears dominating the Brooks Falls in the summer feeding on migrating salmon, and females with offspring and sub-adults foraging closer to the river mouth. We assessed both temporal and spatial genetic population structure among bears that aggregate at Brooks River. From 2005-2007 hair and tissue samples were collected from bears visiting Brooks River. Over 350 samples were collected and genotyped at 16 polymorphic microsatellite loci identifying more than 100 unique individuals. To better understand any temporal structuring we isolated a fragment of the circadian rhythms gene, *clock*, which has been shown to control daily and seasonal behaviors in other mammalian species. Here we present preliminary data on the variation within this gene. In addition, we assess the relatedness between individuals within these spatial and temporal groups.
151: Origin and ascendancy of a chimeric fusion gene: The β/δ-globin gene of paenungulate mammals

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Here we report the presence of a chimeric β/δ fusion gene in the African-elephant that was created by unequal crossing-over between misaligned HBD and HBB paralogs. The recombinant chromosome that harbors the β/δ fusion gene in elephants is structurally identical to the ‘anti-Lepore’ duplication mutant of humans (the reciprocal exchange product of the hemoglobin Lepore deletion mutant). However, the situation in the African elephant is unique in that the chimeric β/δ fusion gene supplanted the parental HBB gene, and is therefore solely responsible for synthesizing the β-chain subunits of adult hemoglobin.

A phylogenetic survey of β-like globin genes in afrotherian and xenarthran mammals revealed that the origin of the chimeric β/δ fusion gene and the concomitant inactivation of the HBB gene predated the radiation of ‘Paenungulata’, a clade of afrotherian mammals that includes three orders: Proboscidea (elephants), Sirenia (dugongs and manatees), and Hyracoidea (hyraxes). The reduced fitness of the human Hb Lepore deletion mutant helps to explain why independently derived β/δ fusion genes (which occur on an anti-Lepore chromosome) have been fixed in a number of mammalian lineages whereas the reciprocal δ/β fusion gene (which occurs on a Lepore chromosome) has yet to be documented in any non-human mammal.

152: Rate of molecular evolution of the interphotoreceptor retinoid-binding protein gene (Rbp3) in Castorimorpha

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The interphotoreceptor retinoid-binding protein (IRBP) is a large protein that functions in regeneration of rhodopsin in the visual cycle. The IRBP gene (Rbp3) has been used in phylogenetic analyses for mammalian interordinal relationships (Carnivora, Cetacea, Didelphimorpha, Notoryctemorpha, Rodentia, etc.) and, in several cases, has been effective in resolving relationships at lower taxonomic levels. However, Chambers et al. (in press) suggested that Rbp3 possesses a lower rate of molecular evolution (0.0060 Kimura's 2-parameter genetic distance; n = 19) in Geomys (pocket gophers) compared to values reported within other mammalian genera. Rates of molecular evolution in Rbp3 were compared to those obtained from the cytochrome-b gene. Several methods were employed to determine if molecular evolution was explained best by models of selection or neutrality. If Rbp3 is critical to vision, one would predict that evolution of Rbp3 would operate under selective constraints; whereas, Rbp3 would evolve at a more neutral fashion in species with less dependence on vision (e.g., fossorial mammals, such as gophers). If a low rate of molecular evolution is typical for geomyids compared to other castorimorphs, then the association of vision and Rbp3 evolution should be further investigated, especially in other groups of mammals possessing small or reduced eyes.
153: Telomere length as a novel, non-invasive method to age American martens (*Martes americana*)

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Demographic structure is central to understanding the status and dynamics of animal populations. However, determining the age of free-ranging animals can be difficult, particularly when studying wide-ranging, elusive or threatened species and when employing non-invasive, DNA-based approaches. Herein, we describe a method to quantify the length of telomeres, DNA-protein complexes that cap the ends of eukaryotic chromosomes, and predict the age-class for free-ranging American marten (*Martes americana*) across North America. Using telomere length and three biologically meaningful predictor variables (individual sex, taxonomic identity [*M.a. americana* vs. *M.a. caurina*] and net primary productivity), we assigned known-age martens to discrete age classes. Presumably because of a combination chronological (cell replication) and biological (hormonal, stress) factors, telomeric attrition was greatest for adult female martens inhabiting low-quality environments. We demonstrate the potential of telomere length in assigning individuals to discrete age classes and provide protocols for future biologists to accurately and non-invasively age free-ranging animals. This approach can be used in concert with other molecular markers to non-invasively acquire information on individual identity, sex and age class.

154: Phylogenetics of the southern pocket gopher (*Thomomys umbrinus*): A multi-locus approach reveals reproductive isolation

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Pocket gophers in the genus *Thomomys* exhibit high levels of chromosomal and genetic differences among populations. These differences often exceed those measured between well characterized species of other mammals, which has made taxonomy and systematics of *Thomomys* a challenge. The southern pocket gopher, *T. umbrinus*, is a poorly studied species broadly distributed from the American southwest to Veracruz, Mexico. Previous research revealed five geographic units based on allozyme and karyological data. These units are comprised of two diploid groups (2n = 78 and 2n = 76) and research has suggested the two chromosomal forms are reproductively incompatible. Here we use multi-locus genetics and phylogenetic methods to fully characterize this species across its range and test hypotheses of speciation mechanisms that may operate in this clade. Preliminary mitochondrial and nuclear datasets were analyzed with maximum likelihood, maximum parsimony, and Bayesian techniques. Thus far, analyses reveal two well-defined clades potentially representing two species. The two diploid groups may come into contact, but they appear to be partly or wholly reproductively incompatible. Further research will investigate the nature of the isolating mechanisms contributing to genetic differentiation in this clade.

155: A test of sociality complexity models in round-tailed ground squirrels (*Spermophilus tereticaudus*): Insight from microsatellite analysis

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Sociality may confer benefits of reduced predation risk or increased acquisition of resources. Ground-dwelling sciurids show a continuum of sociality ranging from solitary individuals to integrated, cohesive family groups. Recent models created a framework of social complexity that explain life history consequences of sociality (e.g. body size, active season length, litter size). Based on these social complexity models, round-tailed ground squirrels are predicted to be an asocial species. Little is known about these small bodied (~125g), desert ground squirrels; however, early observational studies suggest that they form matriarchal colonies. We used field observations and microsatellite analyses to investigate the predictions of these models. We used 7 microsatellite primers pairs from closely related species. Allelic richness ranged from 3-18 alleles per marker, with 4 highly polymorphic markers (>10 alleles.) Five of 7 loci had a low frequency of null alleles and were not in Hardy-Weinberg equilibrium. Average litter sizes ranged from 4.6 to 6.2. These data suggest that subtle population structure occurs, however, matriarchal colonies are not formed. Earlier studies may have overestimated the degree of social complexity in round-tailed ground squirrels, whereas our study supports asociality for round-tailed ground squirrels as predicted in recent social complexity models.

156: Spatial organization of Glaucomys sabrinus: Territory and habitat use

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We studied home range of the northern flying squirrel (Glaucomys sabrinus) in managed forests to determine habitat preference and assess mating strategies. We monitored 22 flying squirrels (7 in 2006, 15 in 2007) from June to October using radiotelemetry. Home ranges were estimated using fixed kernels. Male and female home ranges did not differ in size (mean = 7.35 ± 2.76 SE and 8.92 ± 1.60 SE ha, respectively). Females overlapped home ranges with other females more than with males, whereas males overlapped equally with other males and with females, possibly supporting Wolff’s (1998) offspring defense hypothesis. Use of habitat types was compared to availability using compositional analysis across the entire study area and within the home range. At both spatial scales, flying squirrels clearly selected large mixed-conifer forests over other available habitat types. These observations provide forest managers with important guidelines as the northern flying squirrel is a key prey species for sensitive predators such as the California spotted owls (Strix occidentalis occidentalis).

157: 'Making the best of a bad job' in a highly promiscuous African ground squirrel

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Alternative reproductive tactics are commonly seen in mammals. Often these tactics are affected by condition where reproductively successful males are older, in better body condition, or better at finding females. In Cape ground squirrels, a highly promiscuous species, males appear to have alternative reproductive tactics, either dispersing at reproductive maturity or remaining in their natal burrow. While natal males participate in copulations with neighboring females, they are younger and more subordinate than dispersed males and there appears to be a first male mating advantage based on age and dominance. Because females multiply mate with little likelihood of multiple paternity due to small litter sizes, sperm competition is also a likely factor influencing male reproductive success. We found both dispersed and natal males successfully sire offspring but reproductive success is not distributed evenly between the tactics. We found no differences in testes size or accessory glands but natal males were in significantly worse body condition. Natal males also have a reduced number of breeding opportunities due to smaller home ranges and fewer female encounters. These tactics appear to be conditional where dispersed males
are the most successful leaving younger, subordinate males to make the best of a bad job.

158: Is phenology of Richardson's ground squirrels influenced by climate change?

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We studied phenological events (emergence of adults from hibernation, emergence of litters from the natal nest, immersgence of adults and juveniles into hibernation) in a population of Richardson's ground squirrels (*Spermophilus richardsonii*) in southern Alberta over 21 years (1988-2008), a period more than five times the average longevity of individuals. The study population is located 90 km east of the Rocky Mountains and is strongly influenced by chinook winds, mild air that results from adiabatic warming of dry air as it descends eastward from the mountains to the plains. Our goal was to assess the interaction of the local influence of chinooks with longer-term trends related to climate change. Specifically, we sought to determine whether start-of-season events, end-of-season events, and season length varied across years in a predictable manner. Average dates of emergence and immersgence for adult females were earliest in 1992 (27 February and 20 June, respectively) and latest in 2002 (26 March and 1 August). Active-season length for adult female Richardson's ground squirrels that weaned a litter tended to be consistent across years (usually 109-115 days) regardless of when the season commenced, but season length was unusually prolonged, to 129 days, in 2002.

159: Mechanisms for the avoidance of kin matings in prairie voles

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The ability of an individual to distinguish an unfamiliar relative (e.g., a sibling from a previous litter that dispersed earlier) from non-related individuals could have substantial consequences for the reproductive success of that individual. The individual may experience a reduction in reproductive success should they choose to mate with an unfamiliar relative and those litters experience some form of inbreeding depression. We manipulated relatedness and familiarity of potential mates by placing sexually mature prairie voles (*Microtus ochrogaster*) into 0.1 ha rodent enclosures with familiar siblings (littermates), unfamiliar siblings (siblings from a different litter), and unrelated, unfamiliar conspecifics. Significantly fewer offspring were produced by matings between littermates than expected by random associations, while significantly more offspring were produced from matings of unfamiliar sibling pairings and pairings of unrelated individuals. In contrast, the social data on these animals obtained from live trapping found voles were randomly associating with respect to relatedness (unrelated compared to related), although littermates were more likely to be multiply captured together than unfamiliar siblings. Our findings support familiarity as a mechanism of inbreeding avoidance in prairie voles, with females tending to be the choosier gender.

160: Life in an extreme environment: Using iButtons to explore the foraging ecology of woodrats (*Neotoma*) in Death Valley, California

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Death Valley, CA is one of the hottest and driest environments on Earth, with summer temperatures routinely exceeding 50°C. Living in such extreme thermal conditions undoubtedly poses unique
selective pressures on organisms, yet a number of vertebrate species are found in the hottest habitats at -84m below sea level. One of these is the Desert woodrat (*Neotoma lepida*), a small (80-200g), herbivorous murid rodent that occurs in remarkably high densities on these sites. The presence of this animal is particularly surprising because it lacks any sort of specialized adaptation to heat, and moreover, has a lethal upper critical temperature of 42°C. Here, we report on studies examining how these woodrats survive and prosper in a habitat where ambient temperatures regularly exceed lethal maximums (42°C) for weeks at a time. By using small temperature data-loggers (Thermochron iButtons) attached to rat collars, we characterize the daily activity budget and foraging ecology of these animals in the context of the thermal environment. We find that: 1) movement patterns are tightly constrained by temperature, 2) animals regulate movement to minimize exposure to potential lethal temperatures, and 3) there are seasonal patterns to foraging behavior. We gain important insights into cryptic components of woodrat biology with the aid of iButtons.

161: Phylogenetics of *Rousettus aegyptiacus* and Marburg hemorrhagic fever virus in central Africa

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*Rousettus aegyptiacus* (Egyptian fruit bat) recently has been implicated as a potential reservoir of Marburg virus, the causative agent of Marburg hemorrhagic fever (MHF). Although the range of *R. aegyptiacus* extends across a large portion of Africa, MHF outbreaks have been described primarily in Democratic Republic of Congo, Uganda, Kenya, and Angola. As a first step towards elucidating the relationship between host and virus, we have obtained bat tissues from Cameroon to Tanzania to determine the amount of gene flow among *R. aegyptiacus* populations, which may inform on other areas where MHF might be expected to occur. The cytochrome *b* gene and mitochondrial D loop were sequenced to provide resolution at the species and population levels. Genetic data fails to correspond to the historically defined subspecies and indicates that gene flow occurs over a wider area than has been described previously. This data suggests the current taxonomy of *R. aegyptiacus* is not an accurate portrayal of the intraspecific relationships, and a comprehensive systematic analysis is warranted. This information can significantly aid our approach to emerging diseases, including MHF. While additional factors are certainly involved in its emergence, our results suggest that MHF may not be limited to the Congo basin.

162: The fate of alpine specialists in a changing world: Phylodemography of the American pika

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The genetic consequences of climate-driven range fluctuation during the Pleistocene have been well-studied for temperate species, but cold-adapted (e.g., alpine, arctic) species that may have responded uniquely to past climatic events have received less attention. In particular, we have no a priori expectation for long-term evolutionary consequences of elevation shifts into and out of sky islands by species adapted to alpine habitats. We examined the influence of elevation shifts on genetic
differentiation and historical demography in an alpine specialist, the American pika (*Ochotona princeps*). Pika populations are divided into five genetic lineages that evolved in association with separate mountain systems, rather than lineages that reflect individual sky islands. This suggests a role for glacial-period elevation shifts in promoting gene flow among high-elevation populations and maintaining regional cohesion of genetic lineages. We detected a signature of recent demographic decline in all lineages, consistent with the expectation that Holocene climate warming has driven range retraction in southern lineages, but unexpected for northern populations that presumably represent post-glacial expansion. An ecological niche model of past and future pika distributions highlights the influence of climate on species range and indicates that the distribution of genetic diversity may change dramatically with continued climate warming.

163: Genetic differentiation and the evolution of late breeding in coastal mink (*Neovison vison*)

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The American mink is a semi-aquatic mustelid abundant on the rocky coasts of Alaska and British Columbia. Endemic subspecies which breed 2-3 months later than fur farm and inland mink at the same latitude have been described for the Alexander Archipelago (*N. v. nesolestes*) of southeast Alaska and Vancouver Island (*N. v. evagor*). We used mtDNA cytochrome b and control region sequences to determine 1) whether island subspecies are genetically differentiated from other mink, 2) whether late breeding in the two subspecies reflects shared ancestry or evolved independently, and 3) the affinities of coastal mainland versus interior mink. We found two distinctive mtDNA lineages among coastal mink: one on Vancouver Island and another on the coastal mainland of southeast and south-central Alaska. Alexander Archipelago mink were distinct from the coastal mainland type, but not from mink in interior BC and Alaska. It appears that late breeding evolved independently in *N. v. evagor*, which has a longer history of isolation, and *N. v. nesolestes*, a more recent island colonizer. The divergence of mainland coastal mink suggests both earlier post-glacial recolonization and a role for ecological factors in the origin and maintenance of genetic differentiation of coastal mink.

164: Mustelid diversification along the North Pacific Coast

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Pleistocene glaciations have greatly influenced diversification of high latitude organisms. This is highlighted along the North Pacific Coast of North America, a region noted for its dynamic glacial history, regional and insular fauna, and contemporary conservation importance. Using four variable nuclear loci, we assessed phylogeographic variation in two widespread mustelids along the North Pacific Coast: Marten (*Martes caurina* and *Martes americana*) and ermine (*Mustela erminea*). These nuclear data support the hypothesis that two marten species occur along the North Pacific Coast, and for ermine, suggest that early Pleistocene diversification led to the formation of three independent lineages that may represent incipient species. One species, *Mustela haidarum*, is restricted to islands in the North Pacific and is currently listed as one of British Columbia's most endangered mammals.
165: Characterization of a contact zone in California voles (*Microtus californicus*) with mtDNA, nDNA, and morphology

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California voles (*Microtus californicus*) have been split into multiple subspecies based on skull morphology, pelage and size. However, mitochondrial DNA sequences suggest a single north-south division across this species. Preliminary laboratory work by A. Gill in the 1980's suggested some hybrid breakdown between these two clades. More recent work has shown that these two groups overlap around the San Rafael and Santa Ynez Mountains in Southern California. Their relatively recent divergence allows for examination of secondary contact. We are characterizing this zone of contact with variation in a mtDNA marker (cytochrome b), an autosomal DNA marker (Acid Phosphatase 5), two sex linked markers (introns in DBX on the X chromosome, DBY on the Y chromosome), preliminary microsatellite data, and multivariate and character analysis of skull morphology. We have found unique northern and southern characteristics of all genetic markers, as well as significant morphological divergence in skull morphology. In this presentation we will characterize the variation seen in each marker, and the pattern of contact between these two clades. The most significant finding is different patterns between the mtDNA and nDNA markers. The full extent of the contact area is still under investigation.

166: Phylogeography and systematics of select South American sigmodontine rodent taxa

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We evaluate the phylogeographic and systematic relationships of three of the most common Chilean rodent species of the genus *Abrothrix* and *Oligoryzomys*, members of the Abrothrichini and Oryzomyine tribes, respectively. In addition, we included the second species of *Oligoryzomys* inhabiting Chile, *O. magellanicus. A. olivaceus, A. longipilis* and *O. longicaudatus* characterize for having a wide range of distribution ranging south of the Atacama Desert to the Patagonia of Chile and Argentina, whereas *A. olivaceus* extends from northernmost Chile to the Patagonia. *O. magellanicus* is restricted to some islands in the Strait of Magellan. The phylogeography and molecular systematic relationships of *Abrothrix* and *Oligoryzomys* taxa exhibited different evolutionary patterns along their distributional range marked mainly by the influence of paleoclimatic events particularly in southcentral Chile. *O. longicaudatus*, shows a homogeneous pattern of genetic variation along its range, whereas the reverse is true for *A. olivaceus* and *A. longipilis*. The intraspecific phylogeny for *A. olivaceus* and *A. longipilis* recovered several of the subspecies recognized for these taxa, whereas *O. longicaudatus* constitutes a unique taxon between Atacama and Magallanes regions. Finally, *O. magellanicus* constitutes a good species whose differentiation is a result of the insularity of the Patagonia during the Pleistocene.

167: Ecological scale, density-dependent habitat selection, and coexistence of *Myodes gapperi* and *Peromyscus keeni*

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Differential habitat selection is one of the principal relationships that permit species to coexist. Habitat specialization facilitates coexistence among competing species, however communities often include
generalists whose resource use overlaps that of specialists. Habitat generalists coexist with specialists by exploiting underutilized habitat space. I studied Keen's mouse (*Peromyscus keeni*) and southern red-backed vole (*Myodes gapperi*) populations in rainforest of Southeast Alaska to identify mechanisms that facilitate the coexistence of *P. keeni* with *M. gapperi*. We used live-trap data from 1-ha grids during spring and autumn to compare population density and microhabitat use among gap-phase old growth, multi-cohort old growth, pre-commercially thinned young growth, and peatland mixed-conifer forests.

Correlates of habitat use varied with scale, between seasons, and among habitats. Habitat distribution and microhabitat use varied with density, especially for voles, which at lower densities used less habitat space, becoming more selective across stands and microhabitats. Mouse habitat use was less selective at both scales and not influenced by population density. However, mouse habitat use was influenced by vole abundance, with 89% of the variation in mouse density attributed to vole density. I discuss the implications of these findings for the coexistence of a reputed habitat generalist and mesic forest specialist.

**168: New insights from old lions: The ‘Man-eaters of Tsavo’ revisited**

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The 1980s development of PCR techniques led to “new uses for old rats,” but technology has opened up far more than just systematic and genetic vistas. This point is made at length, using forensic dentistry and stable isotope analyses on two male lions shot 110 years ago in southeastern Kenya. Thought to have raided railway camps together over a 9-month period, the “Man-eaters of Tsavo” supposedly killed and ate 135 men. Forensic dentistry shows that only one of the two lions was incapacitated in a manner precluding its normal predation on ungulates. The man-eaters differ in carbon and nitrogen isotope ratios from lions in Tsavo today, both showing signs of man-eating although to greatly differing degrees. In each, hair samples (reflecting the last half-year of life) showed a far stronger signal for man-eating than bone (which averages diet over far longer time-periods). The skins and skulls, which had become disassociated prior to reaching the Field Museum, could also be confidently re-associated. These analyses show that thorough analysis of basic museum specimens—simple skins and skulls—can document such intangible features as behavior and diet. Given adequate resources and inquiry, the latent information content of most museum collections is incalculable.

**169: Coexistence patterns in a desert rodent community**

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Negative frequency-dependence in growth rates is a signal of stabilizing mechanisms of coexistence in ecological communities. The most crucial result of this negative relationship for persistence is that it enables a species to increase when rare. This has been empirically demonstrated for pairwise interactions. However, in species-rich communities, the effects of competition are not realistically pairwise. In cases where multiple species are competing for a very similar resource, stabilizing mechanisms become increasingly important to ease the effects of that competition. The species-rich desert rodent community at Portal, AZ shows significant negative frequency-dependence in species’ growth rates. In addition, this community shows an inverse relationship between dominance in the community and the strength of stabilization (the strength of negative frequency-dependence). If stabilizing mechanisms become increasingly important as species richness increases, this could be a general pattern of coexistence, in
which rare species experience stronger negative frequency-dependence than dominant species. A mathematical model of community dynamics explores this possibility and may have implications for the ability of changing ecological regions to maintain species richness.

170: Hispid cotton rats as a source of mortality to pine trees invading an oldfield

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During the second summer of a demographic study of the hispid cotton rat, *Sigmodon hispidus*, in an oldfield in eastern Virginia, it became clear that invading loblolly pine trees were dying. All inspected trees had been girdled from ground level to 15-18 cm, a height reachable only by cotton rats, the largest rodent in the community. During subsequent monthly trapping, dying and dead trees were marked with flagging to determine the extent and distribution of this rodent-caused mortality. In late winter and spring, an assistant and I examined all pine trees in 12.5 X 12.5 m 'cells' on the study grid for evidence of partial or complete girdling. In all, 15,800 trees were evaluated. The extent of tree mortality was highly variable among cells, ranging from 2-35%, as were the percentages of undamaged trees (15-88%). Overall, ca. 13% of trees were killed by rodents and a further two-thirds were partially girdled. Analysis of fecal pellets and direct observation suggest that most eating of pine bark occurs in late winter/early spring, a time of sparse and poor-quality food. The bark of other invading trees was not eaten. This is the first account of cotton rats killing pine trees by girdling.

171: Multi-scale habitat selection of a reintroduced American Marten (*Martes americana*) population

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Habitat selection at multiple scales is a crucial element in species conservation and restoration. The American marten (*Martes americana*) was reintroduced to Michigan's Lower Peninsula in the 1980s. In order to gain a better understanding of the habitat use of this species in the Lower Peninsula we analyzed 1) the influence of scale on habitat selection and 2) important land cover classes and habitat characteristics selected by marten at the meso- and micro-scales. We used radio telemetry locations of 13 marten were used to create kernel home range core areas in two populations. Unused forest stands were chosen for a comparison of habitat characteristics using logistic regression and Akaike Information. We found negative selection coefficients for percent deciduous forest, percent water, openland shape index, and forest fractal dimension. At the microscale, there was little separation between models suggesting little or no selection. However, coarse woody debris variables were found in over 80% of the models. Our results indicate that marten prefer forest stands that include conifer patches with greater area to edge ratio with significant amounts of coarse woody debris 15-28cm in diameter.

172: Spatial ecology of raccoon populations in northern Indiana

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In 2003 we initiated a multi-faceted study to elucidate the effects of forest fragmentation on the ecology of raccoon populations in a highly fragmented region of northern Indiana. As a part of this study we estimated home range sizes, movement rates, and habitat selection for 61 raccoons distributed
throughout 21 forest patches. Mean home-range size of males (92 ha) was significantly larger than that of females (58 ha); however, both sexes maintained smaller home-ranges than typically are reported for raccoons in rural landscapes. Moreover, results from our habitat selection and spatial analyses suggest that raccoon home-range size and movement behaviors are strongly influenced by the size and distribution of forest patches in fragmented agricultural landscapes. In particular, raccoon home-range size was influenced by local patch quality, as raccoons occupying small, isolated patches containing limited water sources maintained larger home-ranges than raccoons with home-ranges established in large, contiguous patches containing abundant sources of water. Our results clearly indicate that raccoons have modified their movement behavior in agricultural ecosystems in response to the discontinuous nature of resources, and suggest that the extent of raccoon space use in these ecosystems is strongly influenced by the availability of non-agricultural resources.

173: Body temperature patterns during hibernation in free-living Alaska marmots (Marmota broweri)

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Little is known about the ecology, behavior, or physiology of Marmota broweri, a species endemic to Arctic Alaska. We located a hibernaculum in the northern foothills of the Brooks Range and implanted data loggers into free-living M. broweri to record core body temperature ($T_b$). Information recovered from one sub-adult female shows a hibernation season of 224 days, minimum body temperature of 1.01 °C, and the need to defend thermal gradients of up to 15 °C between the body and surrounding frozen soil. Unlike in other marmot species, re-entry into torpor during midwinter was consistently characterized by two distinct cooling rates that differed by about 10-fold and were separated by a transient temperature increase. In contrast to ambient temperature-dependent slow cooling rates, rapid cooling rates and rewarming rates were not influenced by ambient temperature. In spring, at least six marmots emerged from the hibernaculum suggesting that communal hibernation may be a strategy to reduce metabolic costs while maintaining above-freezing $T_b$.

174: Effect of manipulated den temperatures on body temperature cycling in hibernating black bears (Ursus americanus)

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Hibernating black bears studied in Alaska under semi-natural conditions typically regulate body temperature ($T_b$) between 30-35°C in 2-5 day cycles. In contrast, hibernating bears in Wyoming showed little fluctuations in $T_b$. In the present study, we investigated effects of den temperature ($T_{den}$) on $T_b$ cycling. To minimize effects of seasonality on $T_{den}$, we kept hibernating bears in artificial dens with thermostatically controlled electrical heating mattresses. When possible, den heating occurred in 1-2 dens for two weeks at a time while another group of dens remained unheated. We continuously recorded $O_2$ consumption, $T_b$, $T_{den}$ and outside temperature. Each bear had a unique response pattern with the $T_b$ cycle period strongly correlated to $T_{den}$ ($R^2= 0.55-0.87$). At higher $T_{den}$ (2-6°C) the pattern disappeared and only minor (<1°C) variations in $T_b$ remained. Oxygen consumption was strongly negatively correlated with $T_{den}$ ($R^2= 0.71-0.95$). The $T_{den}$ where the regression line intercepted the expected minimum metabolism of individual bears coincided with the $T_{den}$ above which $T_b$ stopped cycling. We conclude that the $T_b$ cycling is related to thermoregulatory heat production of the bear, mostly by
shivering, and that deep T\textsubscript{b} cycling is not present in the thermoneutral zone of hibernating bears.

175: Active season changes in resting metabolic rate and body composition of free-living arctic ground squirrels

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Arctic ground squirrels (Spermophilus parryii) exhibit an endogenous circannual rhythm of metabolism, body temperature, mass and condition. Late in the active season, animals increase mass and adiposity in preparation for hibernation. We set out to investigate if animals modulate resting metabolic rate (RMR) across the active season. Free-living squirrels were live-trapped and transported to the nearby Toolik Lake Field Station where they were weighed and assessed for body condition (deuterium dilution) and RMR (flow-through respirometry). Animals significantly increased in mass in July and August, accounted for by increases in fat mass. During this period squirrels lost lean mass. From July - September both absolute and mass-specific RMR declined, concurrent with increases in mass. Allometry predicts decreased mass-specific RMR with increasing mass. However, absolute RMR is predicted to increase as animals get larger. Since lean mass is far more metabolically active than lipid and was found to decrease at the end of the active season, we examined RMR on a lean-mass basis. In males, lean mass accurately predicted RMR; however, females decreased lean mass RMR late in their active season, suggestive of metabolic suppression during pre-hibernation fattening. In both sexes, decreases in lean mass effectively decrease energy demands and facilitate fattening.

176: "Some like it hot": Hibernation pattern of the subtropical greater mouse-tailed bat (Rhinopoma microphyllum)

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Many endothermic animals, including bats (Chiroptera), encounter the energetic challenge of seasonal food shortage and low environmental temperatures by performing long torpor bouts, or hibernation. Hibernation is traditionally attributed to high latitudes and cold climates and rarely has been documented in the tropics or subtropics. The greater mouse-tailed bat (Rhinopoma microphyllum) is a 25gr insectivore, found in subtropical Africa and Asia. In Northern Israel (33ºN), it feeds mainly on alates ants. Although the winter in Israel is relatively warm, and insects are abundant, during winter season (November-April) these bats choose to stay in relatively warm caves (20ºC), were they relay on their fat reserves. Captured bats were held in artificial hibernacula. We measured their rates of O\textsubscript{2} consumption and CO\textsubscript{2} production using a temperature regulated open flow system. During hibernation, the bats demonstrated long periods of apnea (4-10 min) followed by a series of fast breaths (85-120 breathes/min). The lengths of the apnea cycles were temperature dependent, and longest around their natural cave temperature. We suggest the mouse tailed bats use apnea as water conserving mechanism during hibernation in relatively warm temperatures, and speculate that they use hibernation as means of saving energy due to their special diet requirements.
177: Seasonal change in bone mineral density in a non-hibernating Alaskan rodent

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Voles and lemmings undergo seasonal changes in their behavior and physiology, which may lead to concurrent changes in bone mineral density (BMD). Our aim was to test whether the BMD of northern red-backed voles (\textit{Clethrionomys rutilus}) in Alaska changed seasonally and whether any changes in its weight-bearing bones were correlated with seasonal changes in photoperiod, body mass, and/or body length. We used dual-energy X-ray absorptiometry (DXA) to measure the BMD of the femur and humerus of voles collected in different seasons. Bone density increased dramatically from the start of spring to its peak level in early summer, and then decreased gradually to its lowest point in late winter. Bone densities were significantly lower in fall and winter than in spring and early summer (p<0.05), and the overall range of bone density appeared slightly greater in males. The BMDs of long bones were significantly correlated with both body mass and photoperiod, which accounted for 46.2\% and 45.7\% of the variation in the BMDs of femur and humerus, respectively. The strong changes that we observed in BMD are likely to be due, in part, to the combined effects of strong seasonal changes in body mass, activity, and baseline levels of reproductive hormones.

178: Seasonality of reproduction in photoperiod responsive and non-responsive northern red-backed voles, \textit{Myodes rutilus}

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Voles and lemmings (SF: Arvicolinae) usually reproduce in warmer seasons, but winter breeding has been documented in several species, including the northern red-backed vole, \textit{Myodes rutilus}. We tested whether this species' reproductive condition is linked to changes in environmental parameters or its body condition, and we tested the frequencies at which different reproductive phenotypes are exhibited under field and laboratory conditions. Free-living voles in southcentral Alaska reached peak reproductive organ masses in spring (females) and early summer (males). Between-subject comparisons showed an effect of body mass, photoperiod, percent fat, temperature, and snow depth on reproductive organ masses, depending on the sex and breeding period (p < 0.05). One instance of late-summer photoperiod non-responsiveness was observed, but we detected no winter breeding. Captive male voles given food \textit{ad libitum} and housed at room temperature exhibited strong phenotypic variation in testis mass in response to short photoperiods. The percentage of non-responders was 28.2\% and within the known range of non-responsiveness for lower-latitude species (20-40\%). Thus, photoperiod non-responsive morphs are conserved in at least one arctic/subarctic species at frequencies comparable to lower-latitude voles. Voles exhibit reproductive elasticity and are likely to breed in winter if environmental conditions enable them.
179: Genetics and taxonomy of moose: One or two species?
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Taxonomy and conservation are inextricably linked because taxonomy provides the framework within which conservation acts. Species and subspecies are taxonomic levels that are of primary concern for conservation, which makes it paramount that taxonomy is correct. In other words, taxonomy should neither recognize groups of animals that do not differ from other such groups nor fail to recognize distinct groups. It is within this framework that we analyze a recent taxonomic change that recognizes two species of moose: *Alces alces* in Europe and western Asia, and *A. americanus* in eastern Asia and North America. Morphological and genetic criteria are given as reasons for the species split. We review the phylogeography and historic demography of moose with reference to taxonomy and conclude that evidence is consistent with a single species.

180: Tracing the dispersal history of *Rattus rattus* and *R. norvegicus* in the U.S.
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*Rattus rattus* and *R. norvegicus* are two of the most successful invasive species of mammals throughout the world and despite the economic damage they cause ($18 billion annually in the U.S.), they remain our least studied mammalian invasive species from a phylogeographic and population genetic standpoint. Our objective was to examine the approximate geographic origins of invasion and levels of gene flow within the U.S. We examined within and among population partitioning of DNA sequence variation using mitochondrial cytochrome *b* gene and 10 nuclear microsatellite loci from populations of *R. rattus* and *R. norvegicus* at numerous collecting localities within the U.S. Our results reveal that multiple genetic lineages of both are present in the U.S. Moreover, both data sets show a pattern of isolation by distance for *R. rattus*, suggesting that this species has been dispersing slowly throughout the U.S. In contrast, neither mitochondrial nor nuclear loci show a pattern of isolation by distance for *R. norvegicus*, and the distribution of genetic variation across the U.S. tends to mimic overland shipping routes, suggesting human-mediated transportation may be a significant form of dispersal for *R. norvegicus*.

181: Are multiple invasions required to explain the diversity of *Myotis* of the Lesser Antilles?
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In the latest edition of the Mammals Species of the World, Simmons identified 38 species of *Myotis* distributed in the New World, of which three occur in the Lesser Antillean region of the Caribbean (*M. dominicensis, M. martiniquensis*, and *M. nigricans*). Thus far, detailed analyses of these species are
almost entirely morphologically based and hypotheses regarding geographic origin of each insular population or species presence/absence have not been tested using genetic data. To better understand diversification of Lesser Antillean *Myotis*, DNA sequence data of the mitochondrial cytochrome-\(b\) gene, nuclear Rag-2 gene, and nuclear Amplified Fragment Length Polymorphisms were phylogenetically analyzed. The genetic distance data for the Lesser Antillean *Myotis* on each respective island are most parsimoniously explained as each insular population being specifically distinct from all other insular populations. This may indicate that there are four species (*M. nyctor*, Barbados; *M. martiniquensis*, Martinique; *M. dominicensis*, Dominica, Guadeloupe; and *M. nigricans*, Grenada) in the Lesser Antilles. Our results provide further evidence for the hypothesis of an old invasion (> 1 MYA) by *Myotis* into the Caribbean. The implications of these data to alternative hypotheses concerning the origin of the bat fauna of the Lesser Antilles are discussed.

**182: Ecological speciation in Central American fruit-eating bats (genus *Artibeus*)**

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Ecological speciation arises when barriers to gene flow evolve between populations as a result of ecologically based selection. Under this model, natural selection is driven by adaptive divergence due to ecological changes or occupation of novel habitats. An interesting corollary to such ecologically driven speciation events is that genetic isolation between populations can arise rapidly. We describe a potential ecologically driven speciation event within Central American populations of the Great fruit-eating bat (*Artibeus lituratus*). The phenotypic variation within Central American populations of *A. lituratus* has been the source of a century old taxonomic debate. This debate stems from the recognition of two size classes within populations of *A. lituratus* distributed throughout Middle America: *A. l. palmarum* (large bodied) and *A. l. intermedius* (small bodied). We present morphological, mitochondrial, nuclear, and ecological data that collectively provide evidence for a recent speciation event. Our hypothesis is supported by: 1) a lack of mtDNA phylogroups in *A. lituratus*, the most widely distributed species in the genus, 2) maintenance of distinct phenotypes and nuclear genotypes in sympatry, and 3) a high correlation between environmental characteristics and phenotype classification.

**183: Molecular divergence in the *Oryzomys palustris* complex: Evidence for multiple species**

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Nucleotide sequences from 49 individuals representing the *Oryzomys palustris* complex (*O. palustris* and *O. couesi*) were examined to assess genetic variation and taxonomic boundaries. Sequence data from the entire mitochondrial cytochrome-\(b\) (1,143 bp) and a portion of exon 1 of the nuclear interphotoreceptor retinoid binding protein (1,221 bp) genes were analyzed using phylogenetic methods (maximum parsimony and Bayesian inference). In all analyses, individuals recognized as *O. palustris* and *O. couesi* formed reciprocally monophyletic clades supporting their recognition as species; however, phylogenetically informative phylogroups were present within each of the 2 nominate clades. In addition, levels of genetic divergence within the recognized taxa exceeded that normally associated with intra-species variation. Together, the phylogenetic and genetic divergence data imply that multiple
species may reside within this complex and that 4 additional species should be recognized.

184: Molecular systematics of the brush-tailed mice of the family Calomyscidae

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Complete sequences of the mitochondrial cytochrome b gene were obtained for representatives of seven of the eight recognized species of Calomyscus. Parsimony and likelihood analyses support the current taxonomy of the genus, i.e., the recognition of the allopatric populations as distinct species. The molecular phylogeny derived from analyses of complete and partial cytochrome b sequences divides the taxa into a northern and a southern clade with the southern clade including C. bailwardi, C. baluchi, and C. hotsoni. Calomyscus bailwardi is the sister taxon of C. baluchi. Our data further define the distribution of C. bailwardi and the potential zone of contact between C. bailwardi and C. hotsoni in southeastern Iran. The northern clade is composed of C. urartensis, C. elburzensis, C. grandis, C. mystax and two undescribed species. Calomyscus grandis is the sister taxon of C. elburzensis and this clade forms a subclade with C. mystax. The Hindu Kush and the central Iranian deserts appear to be the oldest and most substantial isolating barriers dividing the northern and southern clades. The Hindu Kush of northern Afghanistan is proving to be a region of interest as two new undescribed forms have been detected from this region by sequence analysis.

185: Do gender and size affect survivorship and site fidelity in Death Valley Neotoma?

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Death Valley, California is the hottest and driest area in the western Hemisphere. Living in such an extreme thermal environment poses unique selective pressures on organisms, yet a number of vertebrate species survive, grow, reproduce, and even thrive despite the high temperature and aridity. One of these is the desert woodrat (Neotoma lepida), a small, herbivorous murid rodent that inhabits the mesquite clumps that dot the surface of the hyperarid saline Valley floor. Despite habitat severity, densities of desert woodrats are much higher in Death Valley than in other desert environments, and we are interested in why this is so. Mesquite represents the only resource the animals have access to—providing food, water, and thermal and predator protection. We have trapped each of ~40 den complexes within a ~6 hectare site in Death Valley for 4 years. Because woodrats at this site have high site fidelity (>90% of captures at same den complex), we are able to document the entire life history of each animal. Here, we report on differences between "quality" of mesquite complexes and woodrat survivorship and fecundity. Preliminary results suggest a relationship between mesquite complex quality and average adult rat size, gender, reproductive success and survivorship.

186: Ecological predictors of delayed implantation in Carnivora

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The diversity of mammalian reproduction precludes the description of any single standard type. One aspect of this range of reproductive physiology is the occurrence of delayed implantation (DI). DI is a period of diapause during which blastocysts formed after fertilization remain unattached to the female tract instead of immediately implanting. This unusual mode of reproduction appears limited to 9 of the
21 extant mammalian orders. The best studied of these is the Carnivora, in which 67 of the 269 species are known to possess DI. The adaptive significance of DI has been considered many times, but despite good data and extensive effort, attempts to evaluate the data while considering phylogeny have been limited to treating gestation length as a proxy for the presence or absence of DI. However, DI is more appropriately treated as a binary dependent variable. Ives and Garland (2009) have developed a method for performing phylogenetic logistic regression. We use this new method to address 2 questions. 1- Are delays associated with evolutionary changes in body mass, ecological changes in latitude or diet? 2- Does DI exhibit phylogenetic signal?

187: Social mole-rats as aging models - what we have learned, and what is yet to come

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Experimental aging research usually relies on relatively few models like nematodes, flies or mice. Despite their undisputed value, it has been argued that continuous self-restriction on such short-lived models could be misleading because by definition, they do not invest much into a long-lasting soma. Thus, some interesting anti-aging value might remain undetected unless longer-lived species are studied, too. African mole-rats (Bathyergidae) comprise solitary and (eu)social species, the latter living in extended family groups in which typically only the founder pair reproduces. Due to their strict subterranean lifestyle, aging tends to be slow in this family. In fact, naked mole-rats (Heterocephalus glaber) are the longest-lived rodents known (max. >28 y). Comparisons with mice provided unexpected insights into the physiology of aging, some of which could modify our view on the process substantially. Another social bathyergid, Fukomys anselli, is the first known mammal in which reproductive animals live twice as long as their non-reproductive colony mates. This species thus offers the opportunity to study divergent aging rates within the same genotype and might serve as a perfect complement to naked mole-rats. I will summarize our knowledge about aging in mole-rats, the implications for our understanding of the aging process, and future perspectives.

188: Physiological consequences of group living in a plural-breeding rodent

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The social environment is a powerful force that affects multiple aspects of an individual's biology. Glucocorticoids (GCs) - steroid hormones released in response to stressors - are critical mediators of allostatic load and provide a functionally relevant and biologically important measure of physiological response to both existing environments and changes in environmental variables. Previous research has focused on patterns of GC concentrations in high-skew, singular breeding societies, but relatively little is known regarding how the social environment affects the GC response of individuals in plural breeding species in which all group members reproduce. Colonial tucu-tucos (Ctenomys sociabilis) are social, plural-breeding subterranean rodents that live in kin-based groups of up to 8 females. Within a population, both lone and group living females are routinely encountered; this difference in social setting is associated with significant differences in annual direct fitness and survival. To determine if social setting is also associated with differences in GC response, we compared baseline corticosterone (CORT) metabolite concentrations in fecal samples collected from lone and group living females. Lone females had significantly higher concentrations of CORT metabolites than group-living females, suggesting that social setting is an important determinant of physiological condition in this plural breeding species.
189: Elevation variation in life-history characteristics of populations of yellow-bellied marmots (*Marmota flaviventris*)

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We examined life history characteristics of populations of yellow-bellied marmots (*Marmota flaviventris*) at 2900 m elevation and 3400 m elevation to test hypotheses about effects of elevation on life history traits. The accumulation of fat is strongly influenced by short growing seasons and marmots living at high elevations often have shorter active seasons than populations at lower elevations due to prolonged snow cover. We compared growth rates and reproductive effort of marmots amongst age and sex classes from the two elevation sites. Growth rates of yellow-bellied marmots vary significantly with sex, age, and location. Juvenile growth rates were significantly higher at lower elevation sites. Yearlings at the high elevation site had significantly higher growth rates compared to low elevation yearlings. Adult growth rates and masses were not significantly different between elevation sites. At higher elevation, females did not reproduce in consecutive years. Differences in growth rates between elevation sites may be explained by reproductive status and time allocated to foraging.


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The Air Force Academy, an 18,500-acre transitional montane ecosystem, reached unsustainable deer numbers with 1000+ individuals in 1990. Deer densities produced very high deer-to-vehicle accident rates, decreased ecosystem health due to over-browsing, and decreased deer health. This population was significantly reduced from 1990 to 1995 with lethal management measures. From 1995 to 2000 lower harvest levels were used resulting in deer declines from 1000+ animals in 1990 to current levels of 200-350 animals. The extremely high deer density also impacted primary winter-browse, in particular, Mountain Mahogany. From 1990-2000, 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) of Mountain Mahogany to determine deer winter browse effects. A period of high deer population density (35 animals/sq mi; 1990-1994) was compared to a period of lower deer population density (15 animals/sq mi; 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 reduced deer population.

191: Fragmentation and hunting: Deciphering the impacts on mammals in SE Bolivia

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Habitat fragmentation is one of the leading causes of wildlife declines and extinctions. To date over 1000 published studies have analyzed the effects of fragmentation on mammals. Yet we know of only one study on fragmentation that addressed the impact of hunting, and this study failed to control the relative influence of both on the population. Because management actions used to reduce fragmentation (buying land, reforestation) are different than those used to reduce hunting pressure (education
The Chiquitano forests of SE Bolivia are threatened by a recent explosion of farms and the consequent hunting pressure. In these tropical forests we used track-plates and camera-traps to quantify relative abundances of cats (margays and ocelots), tapirs, brocket deer, and peccaries. Results show that fragmentation and hunting have very different impacts on these diverse species groups. The relative abundance of cats were reduced in fragmented sites and unaffected by hunting. Tapirs abundances responded in the opposite fashion with sharp reductions in hunted forests. Finally the relative abundances of brocket deer and peccaries were unaffected by hunting and fragmentation across this landscape.

192: Science and values influencing predator control programs for moose hunters
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We encourage informed decisions regarding Alaska's recently expanded predator control programs. Scientific sanctioning of these programs requires convincing evidence that 1) predators kill substantial numbers of moose (Alces alces) that would otherwise survive or be available for harvest; 2) sustainable harvests of moose can be reliably higher with less predation; 3) given less predation, habitats can sustain more moose and be protected from too many moose; and 4) the viability of Alaska's grizzly bear (Ursus arctos), black bear (U. americanus), and wolf (Canis lupus) populations remains secure. Data support a scientific basis for increasing yield of moose using long-term substantial predator control in a portion of Interior Alaska's moose-bear-wolf systems. However, it remains problematic to predict how a predator control proposal will affect yield of moose. Political decisions regarding predator control policy often change with each governor. The governor appoints members to the Board of Game as well as pertinent agency administrators. We summarize relevant values. Advocates on both sides of the debate each suggest they hold the higher conservation ethic. For biologists to provide guidelines and add substance in this divisive arena, it is essential that biologists be objective, well-informed, respectful, and avoid exaggeration.

193: Influence of sex, age and winter severity on mountain goat survival in coastal Alaska
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Life-history theory predicts that individual survival should vary between sex and age categories due to differences in allocation of nutritional resources for growth and reproduction. During periods of environmental stress such differences are likely to be accentuated. We tested hypotheses regarding the relative roles of sex, age and winter severity on mountain goat survival in coastal Alaska. Specifically,
we used known-fates analyses to model the effects of life-history and climatic variation on survival using data collected from 264 radio-marked mountain goats in 9 study areas over a 30-year period (1977-2007). Overall, multivariate models including age and winter severity but not sex best explained variation in mountain goat survival. Specifically, old animals (9+ years) had lower survival than prime-aged (5-8 years) and young animals (1-4 years). Further, late-winter survival was 40% lower for old animals during severe as compared to mild winters; prime-aged animal survival was 15% lower, by comparison. While survival of young animals demonstrated a similar change in magnitude as prime-aged animals for mild-severe winter contrasts, reduced survival of young animals was most pronounced when snow depth exceeded the historical median. Overall, these findings detail how variable snow conditions interact with basic life-history attributes to influence mountain goat survival.

194: Space use and linear home-range sizes of riparian muskrats in an agricultural landscape

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Small streams and agricultural ditches represent key habitat for muskrats (Ondatra zibethicus) in Midwestern agricultural landscapes. However, few studies have investigated space use and home-range sizes of muskrats in these linear riparian areas. Moreover, we know relatively little about how mammals that are multiple central-place foragers use space within linear home ranges. We radiomarked 42 muskrats at 10 study sites in Champaign County, Illinois that were representative of small streams and agricultural drainage ditches throughout the Midwest. Muskrat movements were linear and confined to stream edges, with an average linear home range of 586 m (SE = 66). However, during periods of inundation, muskrat movements were confined to terrestrial buffer habitat along water edges and close to established burrows. Adult muskrats had larger home ranges than did juveniles. Home-range sizes were negatively correlated with the amount of local food resources (vegetation cover in streams). Individuals with larger home ranges used more burrows. Space use was aggregated within these linear home ranges, with most relocations occurring in or around existing burrows. Understanding how riparian muskrats use this critical habitat will help to inform management efforts by conservation agencies.

195: Site occupancy for riparian muskrats in relation to stream characteristics and environmental change

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Distributions of semi-aquatic mammals such as muskrats (Ondatra zibethicus) may respond to environmental changes including increased urbanization, alteration of hydrology, introduction of invasive species, and changes in predator communities. We completed multiple surveys for occupancy by muskrats at 90 sites in central Illinois in 2007 and 2008. Sites were stratified based on urbanization levels. Occupancy was determined by presence of tracks, scat, and feeding sign in 200-m stream segments that approximated a home-range scale. We calculated detection probabilities to determine the likelihood of false absences. The per-survey detection probability was 0.76 (SE = 0.02), and the detection probability after 4 surveys was 0.997. Muskrats occurred more often at sites with a greater
percentage of developed landcover, as well as in wider and deeper streams that drained more area. Occupied sites also had less sandy soils, steeper banks, greater bankfull heights, and more submerged vegetation cover when compared with unoccupied sites. Year-to-year turnover was explained by water availability and measures of stream size. Although invasive reed canary grass was prevalent at 43.3% of sites, it did not affect site occupancy or turnover. Muskrat distribution was related to local and landscape variables and was insensitive to some aspects of environmental change.

196: An incidence of elevation-caused home range overlap by two populations of white-tailed deer, *Odocoileus virginianus*

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Based on data collected in Southern Albany County, New York from 1991 to 1994, this study consists of documenting observations of White-tailed deer in roadside habitats, noting their numbers and elevation. The observation route included 11 stops, each in the approximate center of 100 ft. elevation intervals of grouped data. Elevation range was from 150 ft. at the point of origin in Delmar, New York, to the highest elevation of 1250 ft. at the Bear Swamp Source Pond, a Nature Conservancy preserve in the Town of Westerlo. The route passed through sections of the Helderberg Mountains that included suburban, rural and succeeding agricultural areas, all of which contained suitable habitat for White-tailed deer. Findings indicated that deer of the Helderberg population followed predictable patterns of moving to higher elevations in summer and intermediate elevations in spring and autumn. Still, elevation means of observations were highest instead of lowest in winter, suggesting an influx from another population, probably from the higher and nearby Catskill Mountains, as these deer traveled to lower wintering areas overlapping with the home range of the Helderberg animals.

197: Testing the coastal refugium hypothesis: A comparative phylogeography approach along the North Pacific Coast

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During the Last Glacial Maximum (LGM - about 20,000 years before present), south-coastal Alaska was covered by the Cordilleran ice sheet. This glacial advance resulted in the extirpation of many species from the region, but isolated coastal refugia that supported periglacial faunas are hypothesized. As the glaciers receded, animals may have re-colonized this region from distinct outer coastal refugia or from southern (e.g., Oregon), eastern (sources east of the coastal ranges), or northern (Beringia) refugia. Molecular genetic analyses of selected mammals have demonstrated substantial spatial structure across this region and several species show multiple, independent colonization histories from more than one source. This area includes the Alexander and Hadia Gwaii archipelagos, both evolutionary hot spots due to high levels of endemism and evolutionary divergence. My dissertation is exploring principles of molecular evolution related to insularity by examining the historical biogeography and contemporary geographic structure of three wide-spread sympatric species: *Sorex monticolus* (dusky shrew), *Peromyscus keeni* (Keen’s mouse), and *Microtus longicaudus* (long-tailed vole).
198: Home ranges of northern grasshopper mice in prairie-dog colonies: Implications for the spread of plague

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Northern grasshopper mice (Onychomys leucogaster) are abundant in colonies of black-tailed prairie dogs (Cynomys ludovicianus), where they may help spread Yersinia pestis, the bacterium that causes plague, by sharing fleas with prairie dogs, and through their resistance to plague-induced mortality. In August and September 2008, we radio-tracked 21 grasshopper mice on a large prairie-dog colony in northern Colorado to investigate the potential for mice to spread plague across colonies. Mean home range area of nine mice located ≥20 times over ≥7 nights was 3.84 ha (SD = 1.64). Based on estimates of the area of prairie-dog coteries (0.17-0.31 ha), we determined that the home range of a single grasshopper mouse could overlap 13-23 coteries. In addition, using our estimate of movement speed (53.7 ± 13.1 m/h) and estimates of nightly activity time (350 min) and the number of burrows entered per 100 m (5.32) from our other studies, we calculated that a grasshopper mouse may enter ~17 prairie-dog burrows each night. The wide-ranging, year-round activity of grasshopper mice, combined with their use of large numbers of burrows, may allow them to transport plague-infected fleas between different coteries, increasing the likelihood of a plague outbreak and the rate of disease spread.

199: Microscopic hair identification: The mammalian fingerprint

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Microscopic hair identification has been used as an analysis tool in a broad range of biological studies and has diverse applications in the fields of wildlife biology, anthropology, forensics, and natural resource management. Examining differences in cortex patterns, characteristics of the medulla, the anatomy of cuticular scales, shape, size, and color can be used to reliably identify mammalian guard hairs. Microscopic hair identification provides a diagnostic tool for identifying mammalian hair and within wildlife biology can applied to a diversity of techniques including presence absence surveys, food habits studies, and nuisance species identification in wildlife damage conflicts. Hair identification is an inexpensive, non-intrusive method of collecting data and can be utilized by virtually anyone. The purpose of this project is to give a brief history of the field of mammalian hair identification, outline some of the basic techniques in examining individual hairs, provide a case study on a current food habits project involving hair identification, and discuss the benefits and drawbacks of utilizing this technique.

200: Analysis of interspecific sperm competition and aggregation in Peromyscus

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Reproductive isolation, a manifestation of speciation, is generated by a number of factors such as geographic isolation, hybrid dysgenesis, and hybrid infertility. However, the mechanism of reproductive isolation leading to speciation among sympatric species is not so obvious. We have recently discovered that sperm from a variety of Peromyscus species form sperm trains (aggregates) in vitro. The sperm undergo extensive head-to-head aggregation to form large agglomerates that swim in a single organized direction and move faster than single sperm. The phenomenon is considered to be an example of sperm
cooperation. Our objectives were to test if sperm competition may be a contributory factor to reproductive isolation, and what role, if any, sperm aggregation may play in this process. *Peromyscus* sperm from different individuals of the same species; sperm from closely related, interfertile species; and sperm from more distantly related species were labeled with Mitotracker dye and the ability to form sperm trains and homotypic or heterotypic aggregates was investigated. Our results indicate that sperm aggregation takes place in both monogamous and polygamous species and is species-specific. Additionally, sperm aggregation was found to be a functional phenomena as all cells within an aggregate had intact tails and heads.

201: Diurnal resting habitat selection of the white-tailed jackrabbit in an intensive agricultural setting

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Declines in the population of white-tailed jackrabbits in Iowa since the mid 1900s, have highlighted the need to collect data on this largely unstudied Species of Greatest Conservation Need. Found throughout much of the northern Great Plains, the white-tailed jackrabbit requires large, open areas to avoid predation during nightly foraging and daytime resting. Continuous expansion of large-scale agriculture potentially limits the availability of that required niche and may be causing population declines. I am conducting a study of jackrabbit preferences for daytime resting habitat in relation to seasonal and agricultural changes on an intensively farmed landscape. To date, we have captured and fitted radio-collars on 8 jackrabbits on an ISU Research Farm. I track radio-collared animals to their resting locations at random times during the day, record vegetation type, and quantify vegetation height and visibility at the resting site. Corresponding data is collected at 2 reference sites to allow comparison between habitat used by jackrabbits versus habitat available. Knowledge of jackrabbit preferences for resting sites throughout the year, will provide information needed to develop a management plan for this declining species, as well as baseline data for comparison to landscape-level changes associated with agriculture and the global climate.

202: Charismatic mammalian megafauna: Public empathy and marketing strategy revisited

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Beer and cider bottles (n = 729) with a nonhuman mammal (or some recognizable part) somewhere on the label were analyzed for the frequency of mammalian orders and families depicted. Twelve orders and 31 families were represented. Carnivores, artiodactyls, and perissodactyls accounted for 90.1% of the sample. Rodents and bats accounted for only 3.3%. Extinct mammals are also underrepresented. Large "charismatic mammalian megafauna" are much preferred as visual marketing symbols on beer and cider bottles because they represent the attributes of strength, power, or tenacity that most people prefer.

203: Cortisol levels from hair and saliva in dogs, *Canis familiaris*

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Hair shows promise as a non-invasive cortisol collection medium compared with blood and provides a more accurate view of long-term hormone levels than point samples of blood, saliva, urine, or feces. Here we validate hair sampling in dogs (Canis familiaris) as a method of measuring basal cortisol values.
in a non-stressful environment. We hypothesized that hair and salivary cortisol levels measured over the same time period would be positively correlated. Hair and saliva samples were collected from 23 Labrador Retrievers and 25 German Shepherd Dogs in their homes. We determined basal hair cortisol values using a wash, powder, and methanol extraction protocol established for Rhesus Macaques. Cortisol levels were compared between a new hair growth sample and several concurrent saliva samples. We report a significant positive correlation between salivary and hair cortisol ($R^2 = 24.2\%$, $p = 0.001$), validating hair sampling as a means to measure basal hypothalamic-pituitary-adrenal (HPA) activity in a non-stressful environment. Our results also show that cortisol levels in new hair growth correlate to those in established hair growth ($R^2 = 42.0\%$, $p < 0.0005$). Thus hair may be a non-invasive vehicle for obtaining cortisol levels in wild mammals.

**204: Functional genomics of winter hibernation in the black bear *Ursus americanus***

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We conducted a large-scale gene expression study using the 12,800 cDNA probe microarray developed specifically for Ursus americanus to detect expression differences in heart, liver and skeletal muscle that occur during winter hibernation in comparison to animals sampled during summer. The Gene Ontology and Gene Set Enrichment analysis consistently showed a highly significant enrichment of the protein biosynthesis category by over-expressed genes in tissues we have compared during hibernation. Coordinated induction in transcription of genes involved in protein biosynthesis is a distinctive feature of the transcriptome in hibernating black bears. These findings imply induction of translation and suggest an adaptive mechanism that contributes to the usual ability to minimize muscle atrophy that bears demonstrate over prolonged periods of immobility during hibernation. Comparing expression profiles in bears to small mammalian hibernators shows a general trend during hibernation of transcriptional changes that include induction of genes involved in lipid metabolism and carbohydrate synthesis as well as depression of genes involved in the urea cycle and detoxification function in liver.

**205: Do male house mice discriminate between females that differ in their ability to retrieve pups?**

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Since male mammals generally provide less parental investment, it is usually assumed that they are not selective in their choice of mates. Therefore, most studies have focused on female mate choice. However, if there is variation among females based on their quality (e.g., speed of pup retrieval), then males may miss the opportunity to mate with a potentially higher quality female because females are also promiscuous. Therefore, selection should favor males with the ability to discriminate among females with whom they could potentially mate. We tested the hypothesis that male house mice (*Mus musculus*) discriminate between females that differ in retrieval status (retrievers versus non-retrievers). Males were given a choice to investigate either retrievers (females retrieving two pups in $\leq 150$ sec) or non-retrievers (females not retrieving two pups within 10 min). Contrary to our prediction, males spent more time investigating non-retrievers than they spent investigating retrievers. Non-retrievers also had a lower percentage of pups that survived from birth to weaning. One possible explanation for why males spent more time investigating females of poorer retrieval status is that non-retrievers may not be investing as much in their current offspring and therefore may be more willing to mate than retrievers.
206: Current status and interspecific associations of the dark kangaroo mouse, *Microdipodops megacephalus*, in Utah

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*Microdipodops megacephalus* (the dark kangaroo mouse) is restricted to the Upper Sonoran sagebrush desert regions of Oregon, Nevada, California, and Utah. Because if its rarity, the biology of *M. megacephalus* is poorly understood. We sampled 101 sites during 2005-2008 in west-central Utah to determine factors that potentially influence the distribution of *M. megacephalus*. In addition, we obtained unpublished data from two other studies on *M. megacephalus* in Utah. Because these mice are subordinate to other small mammals of similar size (e.g., *Perognathus* spp.), we hypothesized that *M. megacephalus* would be relatively common when similar-sized granivores were absent and relatively uncommon when similar-sized granivores were present in the small mammal community. *M. megacephalus* was found in <10% of sites sampled. Results were similar from all three data sets; there was a strong positive relationship (P < 0.01) between species richness and abundance of *M. megacephalus*. Further, there was a positive relationship between the presence of *M. megacephalus* and the presence of dominant species of similar size. Our data do not support our hypothesis. Rather, *M. megacephalus* is only present when the small mammal community is diverse and appear to be one of the first species to disappear as diversity declines.

207: Post-release survival of captive American marten (*Martes americana caurina*)

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Wild-caught mammals may be taken into captivity as part of translocation efforts, rehabilitation or research. Following captivity they can be released back into the wild, donated to a zoo, or euthanized. Although post-release survival of translocated mammals is usually monitored, few studies have assessed the post-release survival of mammals held in captivity for extended periods of time. We followed 5 American martens (*Martes americana caurina*) captured in the Snowy Range, Wyoming, that were released near the site of capture after 15 months in captivity. Radio-tracking from the ground and air was conducted for 4 months until the last marten perished. Of the 5 martens, radio signals from 3 disappeared 0-52 days post-release, 1 died from predation (after 16 days) and 1 from drowning (after 118 days). While alive, the 2 males traveled longer distances (mean 14.5 km) than the 2 females (mean 7.3 km), and none visited the same location twice. These data suggest that extended periods of captivity may be detrimental to post-release survival of martens, and are in accordance with similar studies on post-release survival of river otters (*Lontra canadensis*) and sea otters (*Enhydra lutris*).

208: Larger deer mice are darker than smaller deer mice across the genus *Peromyscus*

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A quantitative assessment of nonagouti (melanistic) vs agouti (wild type) deer mice within a single sub-species of *Peromyscus* (*P. maniculatus gracilis*) indicated that the heaviest animals were female nonagoutis. Thus the agouti allele influenced body size of this specific *Peromyscus* sub-species. Subjective observations of melanistic vs amelanistic species of *Peromyscus* at the USNM suggested that
melanistic species were larger. Here we present data from 44 species of *Peromyscus* to test the general hypothesis that a correlation exists between body size and coat color. Coat color data were assessed by digital photographs and compared with head body length. The data indicate that melanistic species are indeed larger than amelanistic species. Whether the agouti allele is responsible for this larger trend is not known, but these data suggest an interaction between body size and coat color at least in the genus *Peromyscus*.

**209: Mammalogy at the U.S. Air Force Academy**

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The U.S. Air Force Academy (USAFA) has active educational, research, and management programs in mammalogy. The USAFA Department of Biology, which includes several faculty with considerable mammalian experience, offers three popular upper-division courses with substantial mammalogy emphasis. These faculty members conduct mammal-related research in biodiversity, ecophysiology, ectoparasitology, population dynamics, genetics, and zoonotic monitoring, and engage in active collaborations with mammalogists at local universities, museums, agencies, and military installations. The USAFA's Office of Natural Resources is staffed by U.S. Fish and Wildlife Service biologists and foresters who manage a variety of game, non-game, and threatened species, and who address the unique challenges of a military infrastructure and population that is proximate to relatively pristine Front Range wildlife habitat. These diverse activities in mammalogy contribute to the institutional and Air Force missions, and expand the role, participation, and visibility of the USAFA in the larger mammalogy community of Colorado.

**210: Small mammals in tallgrass prairie: variation in community structure**

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Over the last 28 years, we have studied autumn and spring populations and communities of small mammals in tallgrass prairie, as part of the Konza Prairie LTER Project. Data, from our 14 permanent local sites, provide an opportunity to assess factors influencing spatial and temporal patterns in richness and composition of communities. Over the 28 years, 14 species were captured in prairie habitats on Konza Prairie with all species recorded in autumn, but only 12 in spring. However, all species are unlikely to be documented from only 14 local sites in a single season (e.g., autumn average: 8.5 species; range: 6-12). Richness in a particular autumn was related positively to community abundance in the same autumn. Overall, local richness in autumn averaged 3.5 species and ranged from 0-9 species, but values of 7-9 species were uncommon (4% of local samples). Average local richness in individual autumns ranged widely (5.4 species in 1990 to 1.6 species in 2001) and again was related to abundance. The deer mouse (*Peromyscus maniculatus*) was predominant (35% of all individuals) over the 28 autumns, but its predominance, as with other characteristics, varied widely among autumns (17-62%) and local samples (0-100%).

**211: The impact of roadways on mammals in northern New York**

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Road construction and vehicular traffic impact wildlife indirectly by altering the chemical and physical environment in which animals live and directly through automobile collisions with wildlife. In this study we set out to assess the impact of vehicle collisions on mammal populations. We surveyed 6572 km of roads to measure the level of vehicle-induced mortality and to determine whether there were non-randomly distributed areas with high road kill frequencies (mortality "hotspots"). Further, we experimentally tested whether the presence of road-killed animals on the road attracts scavengers and thus results in higher road mortality rates. The minimum average vehicle-induced mortality rate was 7.3 mammals per week (actual value likely 2.7 times higher). 47% of road kills were Rodents, 32% Carnivores, 14% Lagomorphs, 6% Artiodactyls and 1% other mammals. We estimate that more than 5000 mammals per year are killed on roads in St. Lawrence County alone. The presence of dead animals on roadways did not increase the mortality rate of scavengers. Unlike the case for some amphibians and reptiles, we detected no obvious hotspots of road mortality. Factors determining the locations and rates of road mortality are likely species specific, making generally applicable mitigation strategies difficult.

212: Foraging behavior of white-footed mice (*Peromyscus leucopus*) in relation to their perception of predation risk

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We measured the giving-up density (GUD = mass) of seeds in foraging trays treated with predator and control odors to test the hypothesis that the density of *Peromyscus leucopus* (the white-footed mouse) is greater in the edges of forest fragments because there is greater complexity of understory vegetation and therefore lower rates of predation (and perception of risk of predation) in edge than interior habitat. There was no effect of predator odor, habitat type (edge or interior), or fragment size on GUD. Overall, mean GUDs increased (i.e., fewer seeds were eaten) from August to December. GUDs in September (prior to leaf fall) were significantly higher in edge than interior habitat, and the reverse was true in December. This may indicate an increase in the perception of predation risk by mice living in edge habitat following leaf fall. This is supported by the fact that December had a significantly lower proportion of trays used even though it tended to have more mice than August and September. Our results suggest that mice in edge habitat do have a different perception of their risk of predation than mice in the interior, likely due to the greater complexity of understory vegetation in edge habitat.

213: David and Goliath: Ant symbionts buffer against megaherbivore-driven landscape change in an African savanna

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Megaherbivores reduce the growth and survival of adult trees, and thus can maintain landscape heterogeneity in African savannas. However, in other terrestrial ecosystems, anti-herbivore defenses buffer against top-down control, thereby offsetting herbivory as a driver of productivity and plant population dynamics. We addressed two questions: 1) do well-defended adult trees exhibit dampened responses to the loss of megaherbivores, relative to poorly-defended congeners?; and 2) do differences in anti-herbivore defenses employed by adult trees affect the response of tree populations to seed and seedling predation? We combined a herbivore exclusion experiment in Laikipia, Kenya with ant removals and feeding trials with elephants to show that ant symbionts reduced palatability of their host
tree relative to trees that were not defended by ants. Differences in palatability were manifested across broad spatial and temporal scales: productivity of the ant-plant did not change directionally following the simulated extinction of megaherbivores, while that of its congeners increased significantly over 15 years. Life table response experiments demonstrated that rates of population change for the ant-plant were influenced strongly by tree recruitment. Thus, for this unpalatable tree, inconspicuous consumers (i.e., rodents) impose demographic filters via seed and seedling predation because adult trees are unpalatable to megaherbivores.

214: A genetic analysis of Virginia opossum mating systems

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Using genetic techniques we examined patterns of paternity in Virginia opossums occupying a highly fragmented landscape in northern Indiana. During 2008 we collected tissue from female opossums and their pouch young in 55 forest patches distributed over a 1,100 km² region. Using genotypes from 10 microsatellite loci for 596 pouch young from 65 known mothers (= 8.7 young/litter), we determined the minimum number of fathers contributing to each litter using the program GERUD 1.0. Genotyped offspring with known mothers were then analyzed using Cervus, incorporating genotypes from 317 males sampled from 2006-2008 in the same patches where mother-offspring broods were collected to identify potential fathers within our sampled subpopulations. Our analyses revealed that polyandry was common across subpopulations, with 41% of litters having ≥2 sires. Interestingly, despite the fact that we intensively sampled forest patches with sampled mother-offspring broods for potential fathers, we only identified 12 fathers for 13 litters. Our inability to identify fathers within many subpopulations, despite our intensive sampling regime, suggests that opossums undoubtedly utilize multiple forest patches and maintain extensive home ranges in highly fragmented landscapes to attain their metabolic and reproductive needs.

215: The impact of biological invasions on river otters and aquatic-terrestrial linkages in Yellowstone Lake

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Nonnative stressors, lake trout and whirling disease, have contributed to a severe decline in the native cutthroat trout population of Yellowstone Lake. River otters (Lontra canadensis) depend on cutthroat trout as prey, especially during summer when the fish make spawning migrations from the lake into tributary streams. As part of their social behavior, otters deposit excreta at latrine (scent-marking) sites along these spawning streams and fertilize with aquatically-derived nutrients such as nitrogen (N). However, since the introduction of lake trout, numbers of spawning cutthroat trout have declined by more than 90% in some of Yellowstone Lake's tributaries. Continued declines in cutthroat trout may reduce the abundance and distribution of otters and effectively sever the nutrient link between water and land. Presently, a lack of abundance data for otters limits the ability to evaluate whether exotic introductions in Yellowstone Lake have indeed disrupted these linkages. In this project, I am using DNA analyses to estimate the number of river otters in Yellowstone Lake, reconstructing the otter population with bioenergetics carrying capacity models, and evaluating historical declines in river otter abundance and nutrient transfer through analyses of stable isotope ratios of (N) in tree rings from trees growing on otter latrine sites.
216: Indices to estimate body fat content in harvested populations of wolverine (Gulo gulo)

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Monitoring energetic levels in wolverine (Gulo gulo) is made easier due to their relatively high fat contents and the occurrence of discernable fat depots. We sought an index of total body fat based on the relationship between total body fat and easily extractable fat depots. We developed predictive regressions between specific fat depots (popliteal, sternal, omentum, mesenteric and perirenal) and percent body fat (PFat), using 32 wolverine carcasses provided by trappers in Yukon, Canada. Based on explained variance, PFat was best predicted by the sternal fat depot ($R^2 = 0.72$) in males, and by the omentum in females ($R^2 = 0.89$), but the sternal depot also accurately predicted PFat in females ($R^2 = 0.80$). In a test phase, PFat predicted from regressions on sternal depot fresh mass was compared to PFat using 23 other wolverines. Mean PFat in the two datasets were not significantly different, validating the predictive strength of our index. We recommend that the sternal fat depot be used for analyses because of its predictive strength and it is easier to necropsy than any other depot. This new index will provide an opportunity to assess variability in the nutritional condition of wolverine populations.

217: Intraspecific pilfering in larder-hoarding red squirrels, Tamiasciurus hudsonicus

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Pilfering is believed to play a role in the evolution of hoarding strategies; however the role of pilfering in the foraging strategies of larder-hoarding animals is not well understood. Red squirrels are a territorial species that rely on larder-hoarded caches of conifer cones (middens) for over-winter survival in the Kluane region of the Yukon, Canada. The purpose of this project was to (1) determine the amount of pilfering occurring in this population, and (2) to examine variation in pilfering behaviour related to food abundance, age, and sex. In fall 2008 spruce cone hoards were marked using uniquely coloured metal pins to quantify pilfering rates. Middens were also monitored for pilfering behaviour for 2-hour intervals, while the owner was removed and held in captivity. Squirrels who pilfered during an owner absence were significantly younger than non-pilferers. Males and females were equally likely to steal during this time. There was no significant difference between the number of cones cached between pilferers and non-pilferers. It is clear pilfering does occur within this larder-hoarding population; however what drives individual variation in pilfering behaviour remains unclear. Data from the ongoing mark-recapture study of cached cones will further clarify the role of pilfering in this population.

218: Phylogenetic relationship between feral pigs in the USA

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Feral pigs (Sus scrofa) are widespread throughout the world as a result of human introductions. The large feral populations in the USA are thought to be a mixture of domestic swine, Eurasian wild boar, and the hybrids of these two forms. However, no detailed studies have evaluated the ancestry or relative contribution of domestic vs. “wild” pigs to the current population of feral pigs in the USA. Phylogenetic relationships of pigs are of significant interest because of the characteristics of these species as wild, feral, and domestic animals and their suitability for the study of evolutionary patterns and processes. Our
data indicate that domestic pigs contributed significantly to the ancestry of Texas pigs.

219: Small mammals from a cloud forest in the Montañas del Cuilco, Huehuetenango, Guatemala

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Small mammals in the highlands of Guatemala remain poorly studied. Rapid deforestation resulting in habitat elimination necessitates urgent investigation before these highland refuges disappear. We surveyed the remnant mixed hardwood/coniferous cloud forest at elevations ranging from 2950 m to 3160 m at El Retiro, in the isolated Montaña de Cuilco, Huehuetenango, western Guatemala. Removal trapping for 4 days each in July 2008 (wet season) and January 2009 (dry season) resulted in 106 captures representing six species of shrews and rodents. This diversity of small mammals is the lowest that we have recorded from a Guatemalan cloud forest, compared to 10-15 species at other localities. Based on capture rates, the species in order of relative abundance in the small mammal community are *Peromyscus beatae sacarensis* (n = 45), *P. guatemalensis* (n = 34), *Reithrodontomys microdon* (n = 9), *R. sumichrasti* (n = 7), *Sorex saussurei* (n = 6), and *R. mexicanus* (n = 5). The low species diversity may result from habitat destruction by recent large-scale fires and by logging for firewood and lumber. The loss of habitat may have direct effects, but also leads to fragmentation that may restrict reinvasion after fire. This represents the first collection of small mammals from this mountain range.

220: Geometric morphometric analysis of jaw shape in foxes

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We used relative warp analysis to explore patterns of shape variation in the dentaries of 13 species of foxes. The results show 2 major axes of shape variation amongst the species, associated primarily with the coronoid and angular processes, position and shape of the canine, and depth of the ramus. *Urocyon* and *Cerdocyon* formed a group at one extreme while *Vulpes* and *Lycalopex* formed a group at the other. *Speothos* exhibited a jaw shape that was markedly different from that of the other species. Sample sizes were sufficiently large to explore patterns of allometry amongst the 2 *Urocyon* species and *Vulpes vulpes*. Here, the regression of shape on size was significant suggesting a pattern of significant static allometry. Furthermore, the patterns for each of the 3 species were significantly different from one another. Thus, each of the 3 species has a unique allometric trajectory.

221: Seasonal movements and altitudinal migration of reintroduced wood bison (*Bison bison athabascae*) in Yukon, Canada

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In the 1980s, wood bison (Bison bison athabascae), a Threatened species, were reintroduced to southwestern Yukon, Canada. Understanding movements is important to inform recovery planning processes and manage critical habitats, including travel corridors. We affixed GPS collars to 19 female wood bison in order to map their movements and migration in a montane landscape. Wood bison made extensive daily movements (2510 ± 46 m per day). Daily movements differed significantly among seasons (e.g. early-winter, late-winter, fall, spring, and summer; \( F_4 = 31.41; P < 0.001 \)), with bison being most active in summer (3657 ± 145 m) and most sedentary in late-winter (2240 ± 66 m). Interestingly, despite generally being a species most associated with lowland habitats, we observed wood bison making substantial altitudinal migrations. Recorded elevation data indicated that bison spent significant time in alpine habitats, above treeline. Mean daily elevation of relocated bison differed among seasons (\( F_4 = 93.21; P < 0.001 \)), with female wood bison being migrating to higher elevations, above treeline, in summer (1125 ± 15 m ASL) and descending down to lower elevations in fall (859 ± 9 m ASL). Our data are useful in understanding movement and migratory patterns of wood bison in mountainous areas.

222: Identifying hybrids of *Peromyscus leucopus* and *P. maniculatus* in Michigan using molecular genetics

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Classically described, *Peromyscus leucopus* inhabits deciduous forests whereas *Peromyscus maniculatus* prefers open areas. In the Great Lakes region, unambiguous identification of the morphologically similar species is difficult in localized regions where these habitats are closely associated. This suggests that hybridization could be occurring. Unfortunately, little work has explored this hypothesis using modern molecular genetic techniques. A described set of eleven microsatellite loci could distinguish between the two species and their possible hybrid, as it was reported that *P. leucopus* and *P. maniculatus* had unique patterns of amplification. We chose these loci to investigate *Peromyscus* hybridization in Michigan. In 2008, we captured 116 unique individuals. Preliminary mitochondrial sequencing of the cytochrome b region confirmed our species-level identification assignments in the field. However, microsatellite results did not match amplification patterns as described for species nor as expected for hybrids. The microsatellite developers used samples from closed breeding colonies for analyzing these species. We suspect that significant inbreeding would allow for the accumulation of null alleles in these laboratory populations and explain the discrepancies. Although these loci were highlighted for their applications across several species, our study suggests further investigation is necessary to understand the performance of these loci in natural *Peromyscus* populations.

223: Signatures of high-altitude adaptation in the major hemoglobin

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The major hemoglobin genes of the species that inhabit the puna grasslands of the altiplano and
inter-Andean valleys of South America are a likely target of selection, potentially providing a simple molecular mechanism for local adaptation to high-altitude hypoxia (O2 partial pressure is ~60% of sea level at 4,000 meters). Parallel amino acid replacements have occurred independently and are overrepresented in diverse highland lineages, with recurrent substitutions on the α and β heme pockets, α1β1 intersubunit contacts, and phosphate binding sites. Coalescent analyses incorporating the stochasticity of drift and mutation indicate that α and β subunit alleles are less likely to be transferred between highland and lowland populations than alleles at other unlinked loci. Most species inhabiting this region are probably locally adapted to the altiplano, but gene flow may be sufficiently high to retard divergence at unlinked loci in the face of countervailing selection on the major hemoglobin.

224: Inter- and intraspecific variation in personality in two species of sympatric *Peromyscus*

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Variation in behavior was traditionally thought to be highly plastic, whereby animals adjusted behaviors to match specific situations. If animals exercise behavioral plasticity, then behavior should be optimal in all situations. Recent research has identified suites of correlated behaviors (personalities) that are often heritable, are stable over time, and are variable across a population and may explain suboptimal behaviors in nature. In the Great Lakes region, a recent northerly range shift has been observed in the white-footed mouse, *Peromyscus leucopus*, with a decline in relative abundance of its newly sympatric and ecologically similar congener, the woodland deer mouse, *Peromyscus maniculatus gracilis*. I investigated the hypothesis that inter- and intra-specific variation in behavior is facilitating the climate-induced range expansion in *P. leucopus* and the decline in abundance in *P. maniculatus gracilis*. I predicted that *P. leucopus* individuals who are less thorough explorers, more aggressive, bolder, and more active will be on the front line of range expansion. I performed 128 open-field trials on 84 individuals in the Pigeon River State Forest, MI. I used principal component analysis to uncover behavioral axes that represent exploration, activity, boldness, and aggression, in an attempt to help explain the recent changes in range and abundance.

225: Distribution and movements of moose (*Alces alces*) in the Upper Koyukuk River Drainage, Alaska

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We initiated an interagency project to study the movements and distribution of moose existing at low densities in north-central Alaska between the northern foothills of the Ray Mountains and the central Brooks Range, including the upper Koyukuk River and its tributaries. We deployed a total of 58 conventional VHF and satellite GPS-radio collars on both cows and bulls in this approximately 14,000 km² area in March 2008. An additional 10 collars were deployed in October 2008. The collared moose were relocated monthly on radio tracking flights (fixed-wing) while the GPS units record 1-2 locations per day. These data allowed us to follow the movements of individual moose among different Game Management Units and lands managed by 4 different agencies. We have begun to quantify home ranges, maximum and average movements, survivorship and habitat preferences. Our collaring effort has also
facilitated twinning surveys (used as indices of body condition and habitat quality), composition counts, pregnancy rate and disease assessments and calculation of a sightability correction factor during a population estimation survey. Information gathered during this 3-year project will help managers better understand the ecology of moose sub-populations in the area and make informed decisions about harvest regulations and land uses in the region.

226: Ultrasonic vocalization in *Glaucomys sabrinus*

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We used an ANABAT II bat detector to record more than 700 vocalizations by a captive colony of northern flying squirrels. We extracted parameter values for the calls using ANALOOK software, and then performed a principal components analysis to reduce the dimensionality of the data set and to produce a set of orthogonal vectors describing most of the variance in the data. We then performed a series of cluster analyses using the principal component scores, and identified 5 basic call types. Using video footage and an analysis of call sequences, we attempt to discern behavioral aspects of some of the calls. Finally, we assess the feasibility of using passive acoustic sampling to determine presence/absence of northern flying squirrels in the Black Hills of South Dakota.

227: Assessing the predictors of mink dynamics in Quebec, Ontario and Manitoba

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Fur-return records of 50 Hudson Bay Company posts in Quebec, Ontario and Manitoba were assessed for evidence of spatial variation in the influence of different prey species on mink dynamics (*Mustela vision*). Mink, muskrat (*Ondatra zibethicus*) and ermine (*Mustela erminea*; used as an indicator of microtine dynamics) time series were used to identify posts where mink potentially consume both microtines and muskrat. Transformed data were subject to linear regression analyses to determine models that could best predict rate of change of mink populations at each post. Models tested included the rate of change of prey populations and the ratio of predator to prey populations at lags of 0, 1 and 2. Mink to muskrat dynamics, lagged by 1 year, was the best predictor of mink dynamics at 81% of the posts in Manitoba and 47.6 % of the posts in Ontario. The best model for 55.56% of the posts in Quebec was the rate of change of mink densities without lag. Two posts in Manitoba, three in Ontario and three in Quebec exhibited evidence of ermine densities being a predictor with an average $r^2$ value of 0.38. Our results indicate that the driving force of mink populations varies spatially.

228: Is short-term active acoustic sampling sufficient to determine bat species presence?

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Bat researchers predominantly use passive methods to collect acoustic data. Active methods may increase call quality and quantity, but sampling duration is reduced. This reduction minimizes stored data and call analysis time, but does not account for intra-night activity patterns. Our objective was to determine if short-term active sampling is sufficient to determine species presence at acoustic sampling
points. In summer 2008 Anabat II detectors were used to survey bats at 16 sample points in Coastal Plain managed forests of the southeastern United States. Each point was actively sampled for one hour by scanning the area visually and with a detector, orienting the detector towards any located bat. Passive sampling was conducted on the same night as active using standard methods. Call files were filtered to eliminate non search-phase calls, and call parameters were used to quantitatively identify (to species or species group) files containing at least three calls. Passive sampling, on average, produced twice as many identifiable call files and indicated presence of additional species when compared to active short-term sampling. Based on our results, short-term active sampling reduces call analysis time, but may not detect the full complement of species detected with passive full night sampling.

229: Comparison of kernel density and local convex hull methods for estimating utilization distributions

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Accurate utilization distribution (UD) estimation is essential for analyses of mammalian home-range areas, habitat and resource selection, and social interactions. UDs are usually estimated using kernel density estimation (KDE), which has been criticized for its sensitivity to bandwidth selection and for its tendency to overestimate home-range areas. Local convex hulls (LCH) are an extension of minimum convex polygon methods that allows UD construction and may outperform KDE in some situations. We compared the performance of KDE and LCH in reconstructing known UDs from simulated samples of 10, 50, 250, and 1000 location points representing 3 types of space use patterns: clustering of points around a single location, restriction of locations to a network of nodes and corridors, and dominance of a central hole in the UD. For KDE, the reference bandwidth, least-squares cross-validation (LSCV), direct plug-in (DPI), and solve-the-equation were also compared. Overall, KDE performed better than LCH as a UD estimator and provided home-range area estimates with less bias under many, but not all, conditions. LSCV and DPI outperformed other KDE bandwidth selectors, but both undersmoothed low-density portions of clustered UDs. Selecting the best estimator depends on sample size, space use pattern, and the goals of the analysis.

230: Why do beavers abandon their lodges?

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Few studies have examined why beaver abandon their ponds and the comparative dynamics of vegetation surrounding active and abandoned beaver ponds. In an Aspen-boreal ecosystem in Alberta, we compared beaver food availability around active, re-colonized and long-abandoned beaver ponds. We also compared the water chemistry near beaver lodges in all three categories of beaver ponds. There were fewer preferred food around active and re-colonized ponds compared to long abandoned ponds. Biogeochemistry of water around beaver lodges did change with beaver abandonment. These results support the hypotheses that beavers may abandon their ponds due to depletion of food resources or due to poor water chemistry of their lodges. These findings lend to the suggestion that the influence of beaver cyclic colonization, abandonment and re-colonization can have a profound effect on forest succession.
231: Dietary selection in the least shrew Cryptotis parva and factors affecting preferences

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Ten food items common in Madison County NY were presented to three categories - males, non-pregnant females, and pregnant females - of individual captive-bred Cryptotis parva using a two-choice method, with mealworms (Tenebrio molitor) as a reference. A similar pattern of selection was found among all three categories, with isopods preferred the most, followed by harvestmen, crickets, Japanese beetles, redworms, spiders, slugs, fly larvae, forest tent caterpillars, and ladybugs. All food items were less well preferred than mealworms - a high-quality food item with which these animals were familiar. Females preferred all but Japanese beetles, redworms, and slugs more than males, and pregnant females preferred crickets, Japanese beetles, and slugs more than non-pregnant shrews. Shrews, which were given free access to water throughout the experiment, preferred food items with lower water content - thus, higher caloric content per unit mass. The most highly selected food items were also very high in calcium. A preliminary study on use of snail shells by Cryptotis suggested use of extra-dietary calcium in the wild. Energy profitability, calcium content and secondary defense mechanisms of invertebrates likely influence dietary preferences of shrews in the wild.

232: Fleas (Siphonaptera) from a small mammal community in a Guatemalan cloud forest

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The flea fauna of a mammal community at a specific site has never been recorded for Guatemala. We collected 104 small mammals and 323 fleas from remnant cloud forest at 2950-3160m in El Retiro, Huehuetenango, Guatemala. Six species of shrews and rodents were captured. Fleas were brushed off the hosts, preserved in alcohol and later processed and mounted on slides for identification. Plusaetis vermiformis, previously known from a single specimen in Guatemala, was the most common flea but found only on Peromyscus beatae and P. guatemalensis. An undescribed species of Ctenophthalmus was present on Sorex saussurei. Plusaetis mathesoni, found on several rodent host species, is a new country record for Guatemala. A single specimen of an Atyphloceras sp. from P. beatae extends the range of this genus south of central Mexico. Other species present on rodents were Ctenophthalmus sanborni, Baculomeris schmidti, Kohlsia osgoodi, Jellisonia painteri, and Strepsylla sp. Most of the 3 species of Reithrodontomys that we examined had no fleas. Although the mammal diversity was judged to be low the flea fauna was robust and diverse.

233: Does avpr1a microsatellite length influence parental care in male prairie voles? (Undergraduate Student Research Award)

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In many socially monogamous species, pair-bonded males contribute substantially to the care of their offspring. Previous studies suggest that single genes may influence paternal behavior. For example, a microsatellite polymorphism in the avpr1a gene has been shown to influence aspects of paternal
behavior in male prairie voles (*Microtus ochrogaster*); males with longer *avpr1a* microsatellites groomed their pups more frequently than did males with shorter *avpr1a* microsatellites. I investigated the relationship between *avpr1a* microsatellite length and paternal behavior in prairie voles, using males selectively bred to possess *avpr1a* microsatellites substantially longer or shorter than the population average. Maximizing differences in the length of *avpr1a* microsatellites among males should provide a rigorous test of the hypothesis that *avpr1a* microsatellite length is positively associated with amount of paternal care. If *avpr1a* microsatellite length affects paternal behavior, males with longer microsatellites should display an increased frequency of pup grooming, spend more time in the nest with pups, and retrieve their own pup more quickly when it is removed from the nest, relative to males with shorter *avpr1a* microsatellite. However, my results suggest that *avpr1a* microsatellite length does not influence paternal behavior in prairie voles under the conditions of this experiment.

**234: Foraging decisions of nocturnal mice under direct and indirect cues of predation risk**

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The perception of increased predation risk by nocturnal mice and other small mammals has been shown to reduce activity levels, particularly in foraging effort. In this investigation of these effects, cotton mice (*Peromyscus gossypinus*) were used in laboratory trials, and were the most common mouse present at sites used for field trials. This species had not been previously tested, although other foraging studies have used *Peromyscus* species. Previous studies have utilized various cues of predation risk but relatively few have tested the effects of artificial light or manipulated multiple cues in conjunction to assess potential interactions between factors. We used artificial light and various predator scents as cues of predation risk in order to further identify prey foraging responses to these cues and test for interactions between them. Preliminary results indicate that artificial light and fur-derived odors may reduce foraging, but predator urine appears to be ineffective.

**235: The evolution of functional dental morphology in murine rodents (Murinae) as adapted to diet type**

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Dental morphology is directly adapted to the functional properties of the foods consumed. Despite this axiom, only a limited number of biomechanical models have predicted specific morphologies for different diet types. Quantification of functionally relevant tooth characters will determine which morphological features are most indicative of diet. Murine rodents (Subfamily: Murinae) are an excellent study system to address these gaps in the literature because they have divergent diets, tooth morphologies, geographic locations, and a well-resolved phylogeny. This work seeks to quantify which functional dental traits are associated with each diet type and determines the sequence of evolutionary transformations of both diet and tooth characteristics. Murine tooth rows were photographed and a priori functionally relevant characters extracted using ImageJ. Data was analyzed using a number of multivariate techniques on size corrected tooth measures. Phylogenetic independent contrasts were performed and characters were mapped on published multi-gene phylogenies.
236: Dominance and diversity in shrew assemblages in logged boreal forest of northwestern Canada

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Shrews contribute substantially to mammalian diversity in the boreal forest. Yet, they are often overlooked when considering the impact of logging on biodiversity. We used pitfall trap arrays to sample shrews in three habitat types (logged forest, mature forest, and the forest-logged edge) in the boreal forest of southeastern Yukon, Canada. We captured 370 shrews during 43,875 trap-nights. Captures were dominated by Sorex cinereus (69%); other species captured included S. monticolus, S. hoyi, and S. palustris. All trapping sites had ≤2 species present; which always included S. cinereus. Species richness, abundance, evenness, and diversity was greatest in the logged sites and least in the edge sites. Shrew communities were most similar between mature forest and edge habitats (Ps = 89.91%), and least similar between mature forest and logged habitats (Ps = 61.55%). Despite some species being found in much higher abundance in logged stands, all three species in this study had relatively high niche overlap values (>73%), suggesting that all species could be found in similar habitats. We suggest that shrew communities differ dramatically after logging, as larger-bodied species (S. monticolus) exploit modified habitats and likely compete with smaller-bodied species that otherwise are more numerically dominant.

237: Mammal inventory of a new wildlife sanctuary in Ecuador's tropical Andes hotspot

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Wildsumaco Wildlife Sanctuary is a new preserve (ca. 500 ha; ~1400 m elevation) located near Sumaco National Park, in the eastern Andean foothills of Ecuador. Habitat includes primary and secondary premontane rainforest, with some disturbed areas. We initiated a mammal survey in mid-December 2008 using twelve camera traps along the trail system. As of March 2009 we have documented twelve mammal species, with the most common image (not individual) captures being Black Agouti (25), Nine-banded Armadillo (19), Margay (12), Paca (11), and Amazon Red Squirrel (11). Possible images of Oncilla and Jaguarundi await confirmation. Prior observations confirm additional species, notably Spectacled Bear. Total mammal species richness from camera trapping and visual surveys is currently 19. The presence of Spectacled Bear and Margay are noteworthy, considering the low elevation occurrence of the bear and the high abundance of Margays, a near threatened and declining species. Future research will shift from species inventory to density estimates using trapping grids, mist netting, and employing local citizens as parabiologists to assist with mammal surveys. The Wildsumaco preserve offers great potential for scientific study and mammal conservation in this biologically rich and highly threatened corner of the Tropical Andes biodiversity hotspot.

238: Variation in mtDNA, Y and X chromosome sequences reveals congruent phylogeographic structure in Arctic lemmings (Lemmus)

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Arctic lemmings demonstrated strong mtDNA phylogeographic structure across Holarctic with the three significant longitudinal divisions. The depth of phylogeographic splits (mtDNA cytochrome b net divergence 8.7%; 6.2% and 4.5%) suggests continuous vicariant separation over several glacial-interglacial periods. In order to confirm independent evolutionary history of the phylogeographic groups detected by mtDNA variation, we studied sequence variation in introns of Y and X chromosomes. Reciprocal monophyly of all groups revealed by variation in maternal mtDNA marker was supported by genealogy based on variation in paternal Y chromosome. Genealogy based on variation in biparental X chromosome was congruent to the mtDNA and Y chromosome phylogenies, with exception for non reciprocal monophyly of the two Eurasian phylogeographic groups. To investigate extent of introgression, we screened variation in all three markers across an area of secondary contact between the Beringian and Eastern phylogroups in east Alaska - Yukon. Analysis of 65 lemmings, including 44 males, detected 11 hybrids (17%). This finding possibly indicates existence of some reproductive isolation in the North American lemmings due to recurrent isolation by the continental ice sheet during the Pleistocene.

239: Comparative odontology of the living hippopotamids: The gaping truth
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Dentitions of the two living species of hippopotamus, Hippopotamus amphibius and Choeropsis liberiensis were reexamined with regard to tooth numbers and types, and patterns of eruption, occlusion, and replacement. Dental formulae of both species of hippo were found to have been incorrectly interpreted by previous authors. In addition to thegosis, attrition caused by foraging behavior and tongue wear was noted on the incisors. Both species of hippo show dramatic anterior cranial growth changes from newborns to adults. Hippos have ever-growing incisors and canines that have shaped the anterior portion of the skull in both species, for foraging and intraspecific competition. A diastema is produced by lateral displacement of the canine and elongation of the anterior rostrum to compensate for elongation of its root in H. amphibius. The latter factor has drastically reduced the available space for the first premolar, resulting in its elimination from the adult dentition, although the deciduous first premolar often persists into adulthood. An increased time interval between successive molar eruptions in common hippo reflects a possible adaptation to a lifespan of up to sixty years by reserving the eruption of molars with new wear surfaces later into adulthood.

240: Selection of day-roosts by Keen's myotis (Myotis keenii) at multiple spatial scales
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Selection of day-roosts in trees by male and female Keen's myotis (Myotis keenii) was examined at 3 spatial scales (tree, tree plot, and landscape) on Prince of Wales Island, southeastern Alaska, from May to September 2006. We tracked 13 females and 6 males to 62 and 24 roosts in trees, respectively. Selection of day-roosts by males and females was most strongly influenced by characteristics of trees. The odds a tree was used for roosting by female Keen's myotis increased with the presence of defects, increasing diameter, and decreasing bark; increasing quadratic mean diameter in the tree plot; and
decreasing distance to the nearest stream and increasing proportion of old growth in the landscape. Male Keen's myotis exhibited flexibility in types of roosts chosen, but the odds of a tree being used increased with decreasing bark, the presence of defects, and increasing slope-height. The odds a tree was used as a roost by males also increased with the increasing proportion of trees in early to late decay stages in the tree plot. Some habitat features differed between males and females at each spatial scale and differences are likely a reflection of the energetic demands associated with reproduction.

241: Morphometric and genetic delimitation of St. Matthew and Singing vole

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Recent molecular research has called the monophyly of two of Alaska's vole species, Microtus miurus (Singing vole) and the Bering Sea island endemic M. abbreviatus (St. Matthew or Insular vole), into question. Delimiting taxonomic boundaries among closely related morphologically similar species must often rely on multiple lines of evidence, including morphology and genetics. Current classification relies on the geographic isolation and relatively larger body size of M. abbreviatus to differentiate it from Microtus miurus, yet this is based on very few specimens. Here we present preliminary morphometric analyses of craniodental measurements recorded from a large sample that includes Microtus miurus specimens from throughout its known distribution. We found that M. abbreviatus is in fact larger than all populations of M. miurus, which may reflect conformity to the Island Rule. We are also expanding on a previous single-locus molecular study by analyzing genes from multiple inheritance pathways (X, Y, and nuclear autosomal) to examine the potential effect(s) of gene tree/species tree incongruence and the taxonomic status of these voles. This multidisciplinary approach will allow a robust determination of the taxonomic relationships of these Alaskan voles and their adherence to the Island Rule of biogeography.

242: Acoustic identification of bat species using speech recognition techniques and ensembles of artificial neural networks

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Most vocalisations of animals have evolved to convey information on the identity of the calling individual. A significant proportion of this information stems from resonance patterns created by the vocal tract. The echolocation calls of bats have evolved under different selection pressures - not to identify the caller to conspecifics but to locate objects in 3-dimensional space. However, it is possible that vocal tract resonance patterns exist in the calls. Here we provide results from a study that used cepstral coefficients to identify 22 US species of bat from their echolocation calls. Cepstral coefficients encode resonance patterns are the basis of many human speech recognition systems. The dataset included 10 species from the genus Myotis, commonly considered the most difficult to identify acoustically. The performance of the cepstral-based bat classifier was poor (mean correct ID rate 55%) compared with one trained using traditional spectral and temporal call parameters (mean correct ID rate 97%). This work shows that although information derived from vocal tract resonance patterns is not useful for the identification of bats to species level. However, traditional spectral and temporal parameters, coupled with an ensemble-based classifier, are very good for the identification of bats.
243: Phylogenetic systematics of the genus *Holochilus* based on mitochondrial and nuclear data

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The genus *Holochilus* contains semi-aquatic rodents in the tribe Oryzomyini. The current status of the genus is based almost exclusively on morphological data, as well as some karyological data, which have been interpreted differently by various authors. This has resulted in a discrepancy in the number (3-8) of recognized species within this genus. In order to examine the phylogenetic relationships within the genus *Holochilus*, we sequenced 4 genetic markers (Fbg-I7, Adh1-I2, Rbp3, and Cytb) from taxa collected across the range of the 3 currently recognized species. Genetic data were analyzed as individual genes and as a combined data set. Bayesian and maximum parsimony approaches were used to analyze the datasets. The mitochondrial dataset failed to recover a monophyletic *Holochilus*, and genetic distances between the two major clades defined as *Holochilus*, were equivalent to the distances between those clades and *Pseudoryzomys*. Analysis of nuclear sequences revealed a different pattern, depicting a monophyletic *Holochilus*. All datasets recovered at least one and potentially 4 "cryptic" species. This recognition of multiple species within a formerly monotypic group is consistent with recent patterns in which many "new species" are being elevated within the tribe Oryzomyini.

244: Molecular phylogenetics of Reig's short-tailed opossum (*Monodelphis reigi*) and its distributional range extension into Guyana

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Reig's short-tailed opossum (*Monodelphis reigi*) was recently described morphologically, based on a single specimen from southeastern Venezuela. It was considered most similar to *M. adusta*, which is allopatrically distributed in the Andes and surrounding areas, but there has not been an explicit study of systematic relationships with other species of *Monodelphis*. We report the first occurrence from Guyana of this rare species that was previously known by only the holotype. In a molecular phylogenetic analysis of mitochondrial cytchrome b sequence variation, it groups within a well-supported monophyletic clade that includes *M. adusta, M. handleyi, M. osgoodi, and M. peruviana*. *M. reigi* and *M. adusta* were successively basal taxa to the other species. This corroborates earlier morphological studies suggesting close affinity of these taxa. As presently known, *M. reigi* is endemic to the highland regions (> 1,000 m asl) of the Guiana Shield of northern South America, and is the only taxon within the *M. adusta* species complex that does not occur in the Andes or adjacent lowland regions. Based on previous molecular dating of Didelphidae, this suggests that there was a dispersal event from the Andes to the Guiana Highlands in the Miocene that gave rise to *M. reigi*. 
245: Molecular phylogenetics of Myotis and taxonomic changes to the position of Cistugo and M. latirostris

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The genus Myotis has undergone significant taxonomic revision since the advent of DNA sequencing techniques. Prior morphological examination of Myotis has indicated the presence of up to 4 subgenera correlating with foraging strategies. However, recent studies using mtDNA sequence data have questioned the validity of these subgenera and have indicated that several taxa may require reevaluation as to their position within Vespertilionidae. We generated approximately 6900 basepairs of nuclear and mtDNA sequence data to further test previously hypothesized subgeneric groupings for Myotis. We included 21 species of Myotis representing all morphological subgenera previously suggested as well as representatives of all subfamilies and tribes currently recognized in Vespertilionidae and multiple representatives of all other families currently included in the superfamily Vespertilionoidea. Our phylogenetic analyses did not support the morphologically defined subgenera and suggest that morphological similarities among Myotis are the result of convergent evolution. M. latirostris fell outside of Myotis, and the high genetic distance separating it from other Myotis indicates M. latirostris may represent a distinct genus. The genus Cistugo, previously included as a subgenus within Myotis, fell basal to all Vespertilionids with a high genetic distance separating it from Vespertilionidae. We suggest Cistugo represents a distinct family within Vespertilionoidea.

246: Lonchophylla of Ecuador: Evaluating congruence of morphological and genetic data

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Expeditions to Ecuador in 2001, 2004, and 2006, yielded the collection of 38 specimens of Lonchophylla. Since 2004, specimens collected from the northwestern portion of South America resulted in the description of six new species. Evaluation of Lonchophylla specimens utilizing morphological and genetic data is necessary to determine if any of the collected individuals represent recently described species. Karyotypic data available for Lonchophylla consists of a karyotype described for L. robusta and four described for L. thomasi. To establish a relationship of karyotypic, sequence, and morphological data, the first 400 bp of the Cytochrome-b gene were generated and published descriptions were used to morphologically evaluate specimens at the TTU museum. The karyotype of L. robusta was similar to that previously described and this study presents the karyotype of L. concava, which has the same diploid number and a karyotype indistinguishable from L. robusta. Nevertheless, sequence and morphological data separate these two species. Among the most widespread species of Lonchophylla, L. thomasi represents a unique complex of bats which merit further evaluation to understand the diverse karyotypic and sequence data available for these bats. Considering the new species, field keys for Lonchophylla would be highly desirable.

247: What is a species, how are they recognized, and what good are they?

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Lists of mammalian species are commonly produced but generally without extensive comment and justification for recognition. Across any species list the data justifying recognition of a species is
variable. Data that supports specific status is desirable. We evaluate and discuss criteria for such data. Species concept employed, and operational criteria for recognition are crucial. Proposed mechanism of speciation (i.e. allopatric, centrifugal, parapatric, peripatric, or sympatric), data concerning sister taxon status, sympatry, evidence of reciprocal monophyly in genomic, nuclear or mitochondrial genes, conflicts between species trees and gene trees, hybridization, introgression, gene pool integrity, karyotypic uniqueness, allozyme distinctiveness, morphological distinctness (size vs. presence of diagnostic characters), pheromones, biogeographic distribution, phylogroups, vocalizations, pre and postmating isolating mechanisms, evidence of reciprocal monophyly in nuclear or mitochondrial genes are a few of the data that could be provided in such a data set. Methods of analysis (i.e. statistical support and assumptions) niche or micro habitat utilization...the list is as long as the features related to speciation mechanisms. A standardized searchable list of species and associated criteria would assist in understanding biodiversity, data gaps, and selecting groups of species for model studies.

248: Conifer seed selection by small mammals in southwestern Alberta

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Seed predation by small mammals destroys a significant proportion of the annual seed crop of forest trees, and has substantial negative effects on the regeneration of coniferous forests. Preferential consumption of seeds by rodents can dramatically alter overall plant-community structure. While the foods eaten by various small mammal species have been well documented, seed preferences among these species are relatively unknown. This study investigated conifer seed selection by five species of small mammals in the Kananaskis Valley, Alberta: the deer mouse (Peromyscus maniculatus), red-backed vole (Myodes gapperi), heather vole (Phenacomys intermedius), long-tailed vole (Microtus longicaudus), and meadow vole (Microtus pennsylvanicus). Preferences among lodgepole pine (Pinus contorta), white spruce (Picea glauca), and subalpine fir (Abies lasiocarpa) seeds were examined because they are the dominant conifer species in the study area. Experiments were conducted in both laboratory and field conditions. The nutritional and chemical basis for seed selection was also examined.

249: Do Arizona gray squirrels (Sciurus arizonensis) select trees or sites for nesting?

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Knowledge of habitat characteristics important to nest-site placement is critical for the conservation of species of concern. One such species, the Arizona gray squirrel (Sciurus arizonensis), is recognized as sensitive by the Coronado National Forest. However, little is known about basic ecology of the species. We studied an Arizona gray squirrel population in the Huachuca Mountains of southeastern Arizona to determine density, nest-site characteristics, and food habits. We used line transect sampling to locate nests and determine density, and used circular plots to compare vegetation characteristics between nest and random sites. We recorded food habits by observing radio-collared squirrels from 2007-2008. Arizona gray squirrels appear to select for forest structures similar to other tree squirrels, such as number of large trees and snags, canopy cover, number of interlocking trees, and nest-tree height. Nests were in the upper 24% of the nest tree. Diet was diverse and varied between years, with acorns (Quercus) and insects as important food items in 2007 and juniper berries (Juniperus) in 2008. The variety of food items consumed suggests maintaining a diverse forest structure may be important to conservation, especially in environments of variable and patchy rainfall and food availability.
**250: Simulating the impacts of roads on the foraging opportunities of the Indiana Bat (Myotis sodalis)**

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Using empirical data from several studies investigating the movement patterns and behaviour of the Indiana bat (Myotis sodalis), we parametrized a spatially explicit individual-based model (Simulation of Disturbance Activities). Through a series of simulations we explored whether the presence of a road within bat foraging ranges restricted foraging opportunities. We investigated whether foraging movements were influenced by traffic volume, number of traffic lanes, and extent and orientation of suitable foraging habitat within the landscape. Results of these simulations revealed that where vehicles and bats interacted, roads effectively acted as barriers deterring bats from foraging 'across-the-road' during daily excursions. We found a positive relationship between traffic volume and the probability of interaction, e.g., busy four-lane highways restricted bat movement more regularly (up to 25% of daily excursions) than the average two-lane county road (up to 3%). Moreover, the proportion of foraging habitat within the simulated area greatly influenced foraging success. Within landscapes containing a lower proportion of foraging habitat bats commuted further and foraged less. This foraging success was further constrained when the majority of suitable habitat was located 'across-the-road'. Under these conditions roads acted as barriers limiting foraging opportunities.

**251: Modeling movement behaviour of the common brushtail possum**

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Recent innovations (such as light-based geolocators and satellite telemetry) in the means by which location information is obtained from vagile animals have greatly increased the ability to describe the movement patterns of a wide variety of animal species. Unfortunately, the capability to analyse and model such data has not progressed at a rate commensurate with the development of modern tracking technologies. In our presentation we will describe the application of a new Bayesian-based, inferential 'segmentation' model which works to divide trajectories of animal movements into homogenous sections based solely on paired combinations of step lengths and turning angles. To evaluate the operational performance of one such model we applied it to GPS-derived, high-resolution reconstructions of nightly movement paths of common brushtail possums (Trichosurus vulpecula Kerr) in New Zealand. We found that in many instances our model was well able to retrospectively differentiate clusters of 'area-restricted' pseudo-behaviours from interspersed modes of apparent 'commuting' or 'transiting' behaviours. We report relevant outputs and discuss important considerations affecting model results.

**252: Bat use of artificial water sources: Influence of surface area, water depth, and adjacent vegetation**

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Natural water sources for bats are often limited in arid regions. Bats are known to drink from metal tanks used to supply water to livestock; however, the influence of tank characteristics on use by bats is unknown. Infrared video cameras were used to record tank use by bats in the Panhandle of Texas. Two tanks were positioned 80m apart using a cross-over design to account for influence of tank location.
Treatments included 3 tanks sizes (diameters: 1.2m, 1.8m, 3.0m), 3 levels of adjacent vegetation (heavy, light and no vegetation), and 2 water levels (full and half-full). Bats made similar numbers of passes over 3.0m and 1.2m tanks, however bats drank from the larger tank more frequently. Bats made similar numbers of passes over tanks surrounded by light vegetation and tanks free of vegetation but bats drank more frequently from tanks surrounded by light vegetation. Bats passed over and drank more frequently from tanks free of vegetation compared to tanks surrounded by heavy vegetation. Water level had no effect on the number of passes but bats drank less frequently from half-full than full tanks. Our research indicates that using larger, full livestock tanks and managing adjacent vegetation increases use by bats.

253: Evaluating sublethal effects of telemetry on behavior: Pygmy rabbits and radio collars
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Sublethal effects of telemetry on mammals can include changes in activity, movement patterns, foraging, reproduction, growth, and body condition. We assessed whether capture and attachment of radio collars to pygmy rabbits (Brachylagus idahoensis), a species of conservation concern, altered their behavior, body mass, or movement patterns. We fitted adult rabbits with radio collars weighing 5 g (~ 0.9-1.4% of body mass). Frequency of grooming behaviors increased significantly after attachment of radio collars for captive rabbits, however, frequency declined significantly during the week after collaring and rates were close to pre-collaring values after one week. Body mass fluctuated, but did not decline significantly. We tested for changes in movement parameters following capture and collaring of rabbits at field sites in the Lemhi Valley, Idaho. Post-capture movements were significantly elevated during the 2 weeks following collaring, and rabbits shifted centers of space use 100-300 m during the 2 weeks post-capture. However, these differences were not significant during the following bi-week period. Because activity and movement parameters showed short-term variation associated with capture and collaring, we hypothesize that survival of radio-collared rabbits also might be reduced shortly after capture as a function of changes in these behaviors.

254: Big performance, small package: Effects of topography and canopy cover on Argos telemetry
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Technological improvements in Argos telemetry satellites and transmitters potentially expand application of this technology to studies of resource selection by mid-sized mammals. We evaluated the influence of canopy cover and terrain on performance of Argos platform terminal transmitters (weighing about 120 g) configured for a mid-sized, forest carnivore. We modeled the effect of both habitat features on location errors and acquisition rates. Argos transmitters placed at 51 sites operated for 3,571 hours, collecting 3,593 data records. Over 44% of locations were in the highest accuracy class assigned by Argos (i.e. class 3) and had a median error of <162 m. Although performance declined between control sites on mountain tops and test sites in forested areas, neither location errors nor acquisition rates were significantly influenced by either canopy cover or topography. These results are in contrast to
performance evaluations of GPS-based telemetry. We applied probabilistic estimates of location errors derived from our field trials to evaluate the effect of location errors on estimates of home range and core area sizes for fishers in central Idaho. Results suggest that Argos telemetry is a potentially viable alternative to GPS telemetry, particularly when acquisition biases due to canopy cover and topography are of concern.

255: The effects of woody biomass harvest on small mammals

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Current proposals and even some existing projects call for the harvest of logging slash for energy production. Presented here is a study on the impacts of this harvest on small mammals. Three forest stands in northern Minnesota were each divided into the following treatments: clearcut with slash retention, clearcut with slash removal, and control (no harvest). Each site was surveyed for 2 years before harvesting, and one or two years post-harvest. Live mammal trapping followed a Pollock’s Robust design mark/re-capture methodology, with 6 primary periods (months) per year, each with 3-4 secondary periods (nights). Mammals were trapped using live pit traps and Sherman, Fitch, and Ugglan traps. Sixteen species of small mammal were captured 4,857 times in 26,724 trap nights. Comparing pre-harvest and post-harvest as well as harvested versus control treatments showed a significant shift in species abundance. Pre-harvested and control plots were dominated by Peromyscus maniculatus with only occasional captures of Myodes gapperi. In post-harvested sites this ratio was reversed, with a more significant effect in slash-removal treatments than slash-retention treatments. Tamias striatus were common before harvest but were never captured in slash-removal treatments post-harvest.

256: Distribution and population density of plains pocket gopher (\textit{Geomys bursarius illinoensis}) in northwestern Indiana

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Plains pocket gophers (\textit{Geomys bursarius illinoensis}) are listed as “a species of special concern” in Indiana. Three studies conducted during 1958, 1970, and 1988 revealed that populations were declining and their distribution was limited to northwestern Indiana. From May to August 2008 we conducted a fourth study that used multiple survey techniques (e.g. road, transect, and historic location surveys) to examine the gopher population density and distribution in northwestern Indiana. Road and transect surveys were analyzed in DISTANCE 5.0 and estimated $0.01\pm0.0096$ and $0.22\pm0.097$ individuals/hectare. These density estimates are markedly lower than those of previous surveys in Indiana. This apparent decline could result from differences in techniques used and season of surveys rather than from actual decreases in populations. Our 2008 survey systematically searched nine counties where this species was historically present and only four of those counties still contained gopher mounds. Our results suggest a shrinking geographic distribution for this species within Indiana. We suggest a need for future investigations which should: (1) conduct at least 3 road surveys from early spring to late summer per year that are stratified to emphasize core areas of this species distribution in Indiana; (2) conduct walking transect survey on selective historic locations.
257: Competitive interactions with introduced species may threaten endemics: A case of sky island tree squirrels

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Non-native species are a major cause of endangerment for endemic species. One important mechanism may be competitive interactions imposed by the introduced species with which native species have no evolutionary experience. To investigate potential competitive interactions among endemic and introduced species we examined resource competition between Mount Graham red squirrels (Tamiasciurus hudsonicus grahamensis), a federally listed endangered subspecies endemic to the Pinaleño Mountains of Arizona, and Abert's squirrels (Sciurus aberti) which were introduced in 1941. We predicted that Abert's and red squirrels forage at similar locations and use similar food resources, and that Abert's squirrels are more efficient at removing food resources. Thus, we designed an exclusion experiment with two treatments: cones accessible to only red squirrels, and cones accessible to both species. Excluders were randomly placed across the study area and monitored by remote cameras. We calculated and compared cone removal rates between treatments as survival estimates. On average, cones available to both species were removed 3.84 days faster than those available to only red squirrels. Our results suggest that the introduction of Abert's squirrels has led to increased competition and perhaps food limitation for Mount Graham red squirrels, demonstrating one mechanism by which non-natives threaten endemic species.

258: Estimating deer density in Alaska using DNA from fecal pellets

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Effectively monitoring Sitka black-tailed deer (Odocoileus hemionus sitkensis) has been challenging for wildlife managers in southeast Alaska because of the absence of tools to assess population size and trends of deer. Because traditional survey methods (e.g., aerial surveys) depending on direct observation are not possible in the temperate rainforest environment of southeast Alaska, we tested the performance and feasibility of a non-invasive genetic technique that utilized DNA on deer fecal pellets to estimate abundance. During spring 2006-2008, we implemented a sampling strategy in three watersheds on Prince of Wales Island, AK, that allowed researchers to repeatedly survey the same transects and collect fecal pellets from freshly deposited groups. We extracted DNA from each pellet sample and used microsatellite markers to identify individual deer. With unique genotypes and multiple "recaptures" of the same individual deer on subsequent sampling occasions, we used mark and recapture statistics to estimate number of deer on each transect. We determined sample area size using home range data from radio collared deer. Combining watersheds and years, mean density of deer was estimated at 10 deer/km². Our results showed a steady decline in deer numbers over the 3-year study (~40%), which we contributed to consecutive severe winters.

259: Fine scale genetic structure of a large ungulate in Alaska

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Previous studies have shown that Sitka black-tailed deer (Odocoileus hemionus sitkensis) exhibits
population structure between islands in southeast Alaska. We investigated the possibility of intra-island population structure on Prince of Wales Island, Alaska, by extracting DNA from fecal pellets \((n = 376)\) collected in three different watersheds separated by less than 30 km. We used 8 microsatellite markers to identify individual deer \((n=228; PI = 0.0001)\). Diversity was moderately low \((H_o = 0.492)\), and an overall exact G-Test revealed a significant \((P = 0.035)\), albeit low \((\theta = 0.005)\), level of structure. Further analysis revealed two population pairs with significant structure. Results from analyses using Migrate-N suggest few effective migrants between watersheds per generation. We document genetic structure at the watershed level, suggesting the presence of demographic isolation at finer scales than previously indicated.

260: Landscape genetics of feral pigs in southern Texas

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The invasive feral pig represents a threat to the sustainability of multiple agriculture products due to damage and disease risk. Population reduction (trapping or shooting) is the best current alternative for controlling pig damage, but is inefficient because pigs from neighboring areas quickly re-colonize managed areas. We used a panel of genetic markers to investigate feral pig population structure with the ultimate goal of increasing the effectiveness of feral pig management strategies within agroecosystems of southern Texas. We obtained genetic data from >1,200 individuals distributed among 24 south Texas counties. Pigs from the 24 sites clustered into 10 putative populations. Feral populations displayed a moderate degree of genetic structure, indicating that at broad geographic scales, populations are differentiated enough to be functionally independent. However, genetic similarity was not a simple function of geographic distance. We detected the influence of past (and possibly ongoing) translocations, limiting region-wide application of our results. Fine-scale (e.g., county level) analyses revealed that large expanses of homogeneous habitat promote dispersal and movements and would require spatially extensive control efforts to manage feral pigs. In contrast, large expanses of farmland and urban areas were effective barriers to pig movements and could be incorporated into pig management efforts.

261: Genetics used to explain variation in grizzly bear abundance

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Occupancy models do little to explain the influence of habitat on animals where an entire study area is occupied, but can be modified when animals are counted to explain the effect of habitat on abundance. Grizzly bear habitat use has been extensively studied, but only rarely has habitat been linked to demographic parameters such as abundance. We collected bear hairs in 2000 in and around Glacier National Park in northwestern Montana and genotyped the samples to identify individuals. We developed a hierarchical model with 1) explicit landscape and habitat variables that we theorized might influence abundance, 2) covariates to explain variation in detection, and 3) a conditional autoregressive (CAR) term to account for spatial autocorrelation. We analyzed the model using Markov Chain Monte Carlo methods. Road density and percent mesic habitat best explain variation in female grizzly bear abundance, but structure density also has some explanatory power. Road density best explains variation
in male grizzly bear abundance. Management of road density may increase the number of bears in an area, particularly if an area adjoins areas with many bears. We also discuss how habitat influences on abundance relate to migration and climate change.

262: Phylogeography of Matschie's Tree Kangaroo (Dendrolagus matschiei) from Huon Peninsula, Papua New Guinea

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Matschie's tree kangaroo (Dendrolagus matschiei) is a unique arboreal macropodid marsupial listed as endangered. D. matschiei inhabits a broader altitude range than other closely related tree kangaroos, possibly because D. matschiei is the only tree kangaroo species on the Huon Peninsula, Papua New Guinea (PNG). Tree kangaroos have undergone an extensive radiation and diverged into at least ten species. Genetically unique populations of D. matschiei may exist at different altitudes or in isolated areas and warrant management as separate conservation units. We sequenced the partial mitochondrial DNA control region gene from D. matschiei at four field sites (n = 111) within the Yupna-Urawa-Som (YUS) Conservation Area and D. matschiei captive held at the Rainforest Habitat (n = 8) in Lae, Morobe Province, PNG, to investigate phylogeographic structure and identify conservation units. D. matschiei showed evidence of phylogeographic structure and the geographic distribution of their haplotypes maybe due to barriers to dispersal - such as low valleys and major rivers. D. matschiei within the YUS Conservation Area should be managed as one conservation unit because we were unable to detect any diagnostic characters that corresponded with geography. An improved understanding of D. matschiei landscape genetics will contribute substantially to their conservation.

263: Population structure of an arctic ice seal: Support for conservative management

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In 2008, a petition was made to list Arctic ice-seals as Endangered Species. Ringed seals (Phoca hispida) are the primary prey of polar bears and a food source for native people throughout the Arctic. They mate, rear pups, molt, and rest on the sea ice surface. The depletion of Arctic sea ice causes habitat loss for ice-associated seals. Their capability to quickly adapt to the changing environment depends on their population structure. Two methods were employed to study ringed seal population structure. Satellite tags determined whether adults bred annually at the same location, while mitochondrial and nuclear DNA was used to test our hypothesis: ringed seals have multiple populations localized around breeding sites, rather than a single circumpolar population. During the breeding seasons of 2005-2008, 27 seals were tagged. Microsatellite and mitochondrial DNA markers from nearly 400 seals were analyzed to reconstruct their population structure. To date, 11 of the tagged seals have been followed between consecutive breeding seasons, all have returned to the same sites. Genetic analyses suggest there is ongoing gene flow between breeding sites, facilitated by juvenile dispersal. Alternatively, there may be many genetically-isolated populations that have yet to begin expressing the effects of genetic drift.
264: The Andes Mountains, human impact, and the genetic structure of vampire bats

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Without human intervention, species distributions are dictated by suitable environmental conditions and limited by geographic barriers, such as rivers, mountain systems, or other unsuitable habitats. An example of an effective geographic barrier is the Andes cordillera. Here, we investigate whether the effects of human disturbance can override the natural isolation of populations of the common vampire bat (*Desmodus rotundus*) that occur on opposite sides of the Andes. In order to test our hypothesis we explore the genetic constitution of Ecuadorian populations of *D. rotundus*. For n>130 individuals, we sequenced the entire mitochondrial cytochrome-*b* gene and a fragment of the fibrinogen B beta polypeptide gene. Phylogenetic and computational geographic analyses revealed high mitochondrial DNA structure between populations from opposite sides of the Andes, and little nuclear DNA structure among populations. This type of variation in the mitochondrial and nuclear genomes is indicative of an asymmetric dispersal pattern where gene flow between groups is based almost entirely on male dispersal events. Our results point out that for some species the high human disturbance in the Andean region may result in overlap in the current distribution of populations from each side of the Andes and permit contact and potential introgression of divergent populations.

265: Development of an index for estimating abundance in pygmy rabbit populations

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The pygmy rabbit (*Brachylagus idahoensis*) is a cryptic, burrowing lagomorph currently under consideration for ESA listing, and an efficient method to monitor populations is needed for conservation planning. We evaluated an index of abundance based on density of active burrow systems. We used mark-resight surveys of 80 radio-collared individuals to estimate density of rabbits and conducted censuses of burrow systems at 7 sites (57.2-118.5 ha) in the Lemhi Valley, Idaho. We also used snow-track surveys to estimate numbers when conditions permitted. Density of active burrow systems varied from 0.19 to 7.55/ha and density of rabbits ranged from 0.02 to 0.46/ha. Model selection analyses of mark-resight data indicated support for individual heterogeneity in resighting probabilities at most study sites. Population density increased linearly with density of burrows, which explained about half of the variation ($R^2=0.51$). We explored the influence of other factors, including numbers of burrows used per individual, distance between burrow systems, and vegetation cover and structure. Our results suggest that density of burrows could serve as an index to relative abundance of rabbits within sites, but when examining abundance at larger spatial scales or among areas, site level covariates should be evaluated and incorporated into estimates of population density.

266: Density of white-tailed deer at Vicksburg National Military Park

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Vicksburg National Military Park (VNMP) is assessing three alternative landscape treatments to preserve historical and cultural features as they were during the Civil War. VNMP required baseline data to assess impact of treatments and white-tailed deer (*Odocoileus virginianus*) were used as the model species. Our objectives were to examine density and distribution of white-tailed deer for summer, fall, and winter prior to landscape treatments. Density was estimated using distance sampling by
spotlighting along established roads. Distribution of deer was based on locations determined from spotlight surveys. For summer, fall, and winter we observed a total of 69 groups, 75 groups, and 86 groups, respectively. Mean group size was 1.97 (0.8 SE) in the summer, 1.97 (2.0 SE) in the fall, and 3.5 (1.9 SE) in winter. Density in summer, fall, and winter was 1 deer per 9.0 ha (1.8 SD), 1 deer per 6.0 ha (4.1 SD), and 1 deer per 3.9 ha (4.25 SD), respectively. Deer were randomly distributed in summer (Moran's I = 0.36, p = 0.09) and fall (Moran's I = 0.10, p = 0.68), and clustered in winter (Moran's I = 0.35, p = 0.0001). We expect an increase in deer density following landscape treatments.

268: Population dynamics of white-footed mice (*Peromyscus leucopus*) in a tornado-impacted forest in southern Illinois

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In May 2003 an F4 tornado with wind speeds ranging from 330-416 km/h traveled through Mermet Lake Conservation Area (MLCA) in southern Illinois and impacted 166 ha of forest. Our objective was to compare the population dynamics of white-footed mice (*Peromyscus leucopus*) in disturbed and undisturbed habitats. Two transects in disturbed and undisturbed habitats were sampled monthly from October 2004-October 2005. Five-hundred forty-seven individual white-footed mice were captured 1355 times at MLCA. They composed 77.9% of the 702 individual small mammals captured during 8454 trap nights. Overall, population measures on all four transects peaked during November 2004-January 2005, then began to decrease toward the end of the trapping period. Numbers of white-footed mice captured on disturbed transects were an order of magnitude greater than on the undisturbed transects. Undisturbed and disturbed sites were significantly different in their monthly abundance estimates. There was a highly significant time effect in monthly abundance, as well as a highly significant interaction between the treatment and time effects. Average monthly apparent survival of white-footed mice was not significantly different between the disturbed and undisturbed transects. More reproductively active males and females were captured on the disturbed transects, although on a percentage basis, transects were similar.

269: Maternal programming, prenatal stress, and the 10-year snowshoe hare cycle

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Numerous studies have shown that maternal stress during pregnancy has life-long effects on offspring. Prenatal stress has been linked to depression, anxiety-like behaviours, alterations in HPA function and brain development, and a decrease in survival and reproduction. However, these experiments have been conducted in the laboratory and their relevance to the free-living mammals is unclear. The 10-year snowshoe hare cycle is intimately linked to fluctuating predation pressure and predation risk. We have shown that this results in fluctuating stress levels in pregnant hares. In the Yukon, we tested the hypothesis that chronically elevated cortisol concentrations in dams increased the stress of their offspring at the population level. Using both a natural monitoring study and an experimental manipulation we assessed cortisol concentrations in dams and offspring. We found that there was a direct relationship between the cortisol concentrations of dams and that of their offspring. Furthermore, the ability of offspring to handle a stressor was directly linked to that experienced by its mother. We discuss the implications of these results for the snowshoe hare cycle.
270: Interannual variation in sensitivities of vital rates of old-field rodents

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Populations are differentially sensitive to change in survival and reproduction. Natural selection is expected to act on the vital rates that most influence the population growth rate resulting in these rates having the lowest variance, a hypothesis known as canalization. We have demonstrated this pattern in three populations of rodent in northeastern Kansas using means of vital rates estimated from time series of data. In the present study we estimated the sensitivity of the population growth rate to change in survival and fecundity using monthly estimates to test the hypothesis that the most sensitive vital rates are consistent over time. We used estimates of survival and fecundity in four species—Sigmodon hispidus, Microtus ochrogaster, Peromyscus leucopus, and P. maniculatus—to synthesize monthly matrices and used the perturbation method to calculate sensitivities. We rank ordered the effect of change in vital rates and compared these results to those of the mean matrices. Rank orders of monthly sensitivities differed considerably from those estimated from mean matrices in all species in at least some months. These results show that vital rate sensitivity varies among years and suggests that populations exhibit canalization even in the presence of this variability.

271: Small mammals in shortgrass prairie in Texas: Composition, abundance and dynamics

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s Bar Cooperative Management Area is a 4,856 ha shortgrass prairie that has been heavily invaded by mesquite and cholla. We began sampling the small mammals at Cross Bar in 2004 as part of an inventory in association with a large-scale, replicated study of the influence of fire and fire frequency on small mammals. We established 18, 15-station transects in 3 fire treatments: frequent fire (2-3 year fire-return frequency), moderate fire frequency (4-6 year fire return frequency), and unburned. Small mammals were sampled for 3 consecutive nights during 17 trapping sessions. We captured 685 individuals of 14 species of small mammals during 13,770 trap nights. Sigmodon hispidus was the most abundant species (n=154), followed by Peromyscus leucopus (n=111), Reithrodontomys montanus (n=96), Chaetodipus hispidus (n=95), Onychomys leucogaster (n=72), and Neotoma micropus (n=60). The remaining 8 species accounted for only 14% of all individuals captured. Capture success averaged 4.97 individuals/100 trap nights and ranged from a low of 0.86 individuals/100 trap nights in fall 2008 to a high of 11.89 individuals/100 trap nights in fall of 2005. Seven different species were the most abundant species captured during each of the 8 spring and fall trapping seasons.

272: Large terrestrial mammals: Population dynamics, politics, and perils

R. Terry Bowyer. Department of Biological Sciences, Idaho State University

Life-history characteristics of large mammals are not simply those of small mammals scaled large. Obvious differences include large body size and associated allometric and digestive differences, long life span, small litter size, extended maternal care of young, and strong density dependence. These traits have led to populations in which carrying capacity (K) is important. There is considerable confusion in the literature concerning K and how it is determined. Too often K is discounted as a useful tool to understand population dynamics because it can be difficult to measure. One misconception is that K is not meaningful because it is a constant in the logistic equation, and environmental conditions vary. This
observation, however, is not a valid criticism of $K$ as a concept. Herein I explore how conceptual models of population dynamics, including the importance of compensatory and additive mortality, can be used to understand both theoretical and applied aspects of the ecology of large mammals. I consider how politics can affect the wise management of these important natural resources. Finally, I discuss what I foresee as the greatest perils facing the conservation and management of large terrestrial mammals in North America.

273: Darwin remembers: A recollection of life's journeys

Floyd Sandford, Coe College

It is October 1881 and an elderly Charles Darwin in the last year of his life is greeting some unexpected visitors to his home, Down House, in Kent, England. As Darwin recollects aspects of his life's voyage, he shares with his audience the important milestones of his personal life and scientific work.
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