



International
**Urban
Wildlife**
Conference
Portland 2019



CONFERENCE
PROGRAM





International Urban Wildlife Conference JUNE 2ND – 5TH 2019 in Portland, Oregon AT PORTLAND STATE UNIVERSITY

Schedule at-a-glance

	Sunday, June 2nd	Monday, June 3rd	Tuesday, June 4th	Wednesday, June 5th
8:00 AM	Registration Open	Registration Open	Registration Open	Registration Open
9:00 AM	Field Trips	Plenary Session	Concurrent Sessions & Workshops	Concurrent Sessions & Workshops
10:00 AM				
11:00 AM				
12:00 PM				
1:00 PM				
2:00 PM	Concurrent Sessions & Workshops	Evening Social & Working Group Meeting: OMSI	Closing Plenary	
3:00 PM				
4:00 PM				
5:00 PM				
6:00 PM				
7:00 PM	Welcome Social: Oregon Zoo	Poster Session: PSU		
8:00 PM				



Welcome to the

2019 INTERNATIONAL URBAN WILDLIFE CONFERENCE

Hello and Welcome to Portland!

I am pleased to welcome you to the 2019 International Urban Wildlife Conference. Thank you so much for your participation and support for this unique conference. This year's theme of collaboration and conservation emphasizes how our research, community connections, and conservation efforts can benefit both wildlife and the people who coexist with them.

I am proud to be a part of this conference, and the Urban Wildlife Working Group, the driving force behind the IUWC. I am excited to join you in learning from the research and experience of our colleagues across the world as we commence the 2019 International Urban Wildlife Conference.

Sincerely,

Leslie Bliss-Ketchum

Portland Host Committee Chair
Board member of the Urban Wildlife Working Group
Director and Founder of Samara Group LLC

This program booklet was designed by Samara Group, LLC
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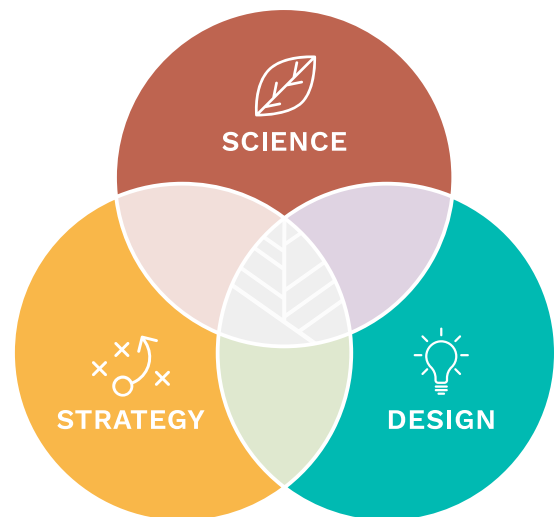
**WE ARE A TEAM
OF FACILITATORS,
PLANNERS,
DESIGNERS,
RESEARCHERS,
WRITERS,
EDUCATORS.**

**TOGETHER WE
TACKLE COMPLEXITY.**

THE **SAMARA APPROACH**

Samara Group is an innovative, creative and cross-disciplinary consulting firm. Come find us at our booth to find out more about our approach and our unique blend of science, strategy, and design.

www.samarapdx.com



Events / Education / Grants



BOTSTIBER INSTITUTE FOR WILDLIFE FERTILITY CONTROL

The Botstiber Institute for Wildlife Fertility Control aims to advance the use of sustainable, effective fertility control methods to manage wildlife populations worldwide.

To achieve this goal the Institute educates policymakers, wildlife professionals and the public by hosting workshops and events, serving as a resource center and awarding grants.

www.wildlifefertilitycontrol.org

ADDITIONAL SUPPORT PROVIDED BY

Wildlife Acoustics, Inc.

&

**National Wildlife Federation
Northern Rockies, Prairies, and Pacific Region**

Conference Planning Committees

This meeting would not be possible without the volunteer efforts of many individuals. Thank you to everyone who has made this meeting a success!

PORTLAND HOST COMMITTEE



WEBSITE, FIELD TRIPS, REGISTRATION & LOGISTICS

Leslie Bliss-Ketchum	Committee Chair Samara Group
Marie Hepner	Assistant Chair Samara Group
Olivia Guethling	Branding & Graphic Design Samara Group
David Cohen	Local Arrangements Intertwine
David Helzer	Field Trips City of Portland Environmental Services
Lori Hennings	Program Development Metro
Bob Sallinger	Field Trips Portland Audubon
Katy Weil	Local Arrangements Metro

Additional thanks to Han Li and Pam Thompson for communications support

URBAN WILDLIFE WORKING GROUP



PROGRAM, PLENARY, & TRAVEL GRANT COMMITTEES

Liza Lehrer	UWWG Chair, Plenary Session Committee, Travel Grant Committee Urban Wildlife Institute, Lincoln Park Zoo
Nils Peterson	Program Chair, Plenary Session Committee North Carolina State University
Courtney Aiken	Program Committee Cooper Ecological Monitoring
Sarah Aucoin	Program Committee New York City Parks
Jay Boulanger	Program Committee University of North Dakota
Nicki Frey	Travel Grant Committee Utah State University Extension, Jack H. Berryman Institute
Travis Gallo	Program Committee, Plenary Session Committee Urban Wildlife Institute, Lincoln Park Zoo
Richard Heilbrun	Program Committee Texas Parks and Wildlife
Madhusudan Katti	Program Committee North Carolina State University
Han Li	Program Committee University of North Carolina, Greensboro
Seth Magle	Program Committee Urban Wildlife Institute, Lincoln Park Zoo
Christopher Moorman	Program Committee North Carolina State University
Maureen Murray	Program Committee Urban Wildlife Institute, Lincoln Park Zoo
Jennifer Murrow	Program Committee, Travel Grant Committee University of Maryland
Chris Schell	Plenary Session Committee University of Washington
Adam Rohnke	Travel Grant Committee Mississippi State University Extension



The Urban Wildlife Working Group

2019 EXECUTIVE COMMITTEE MEMBERS

Liza Watson Lehrer (Chair)

Urban Wildlife Institute, Lincoln Park Zoo

Maureen H. Murray (Secretary/Treasurer)

Lincoln Park Zoo

Richard Heilbrun (Chair-elect)

Texas Parks & Wildlife Department

Nils Peterson (Past Chair)

North Carolina State University

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University of Missouri

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University of California, Berkeley

Downtown Portland



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Smith Memorial Student Union (SMSU)

BASEMENT

SOUTH PARK BLOCKS



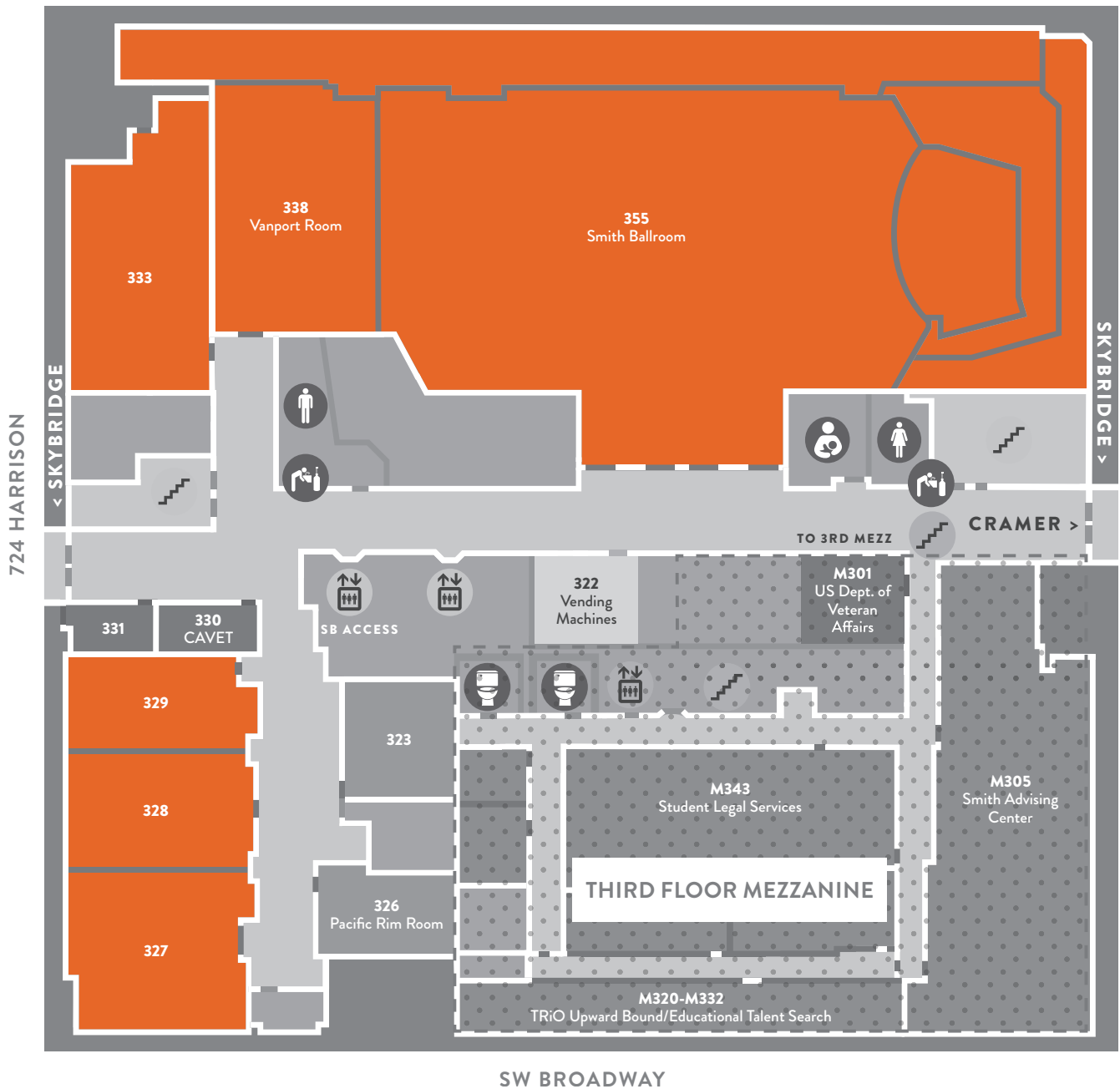
Smith Memorial Student Union

SECOND FLOOR



THIRD FLOOR

SOUTH PARK BLOCKS



Plenaries, Workshops, and Social Events

Sunday, June 2

8:00 AM – 5:00 PM

Registration

PSU SMSU Room 333

Enter from SW Broadway

7:00 AM – 5:00 PM

Field Trips

Various Locations

6:00 PM – 9:00 PM

Welcome Social

**Oregon Zoo
4001 SW Canyon Rd, Portland**

Monday, June 3

7:00 AM – 5:00 PM

Registration

PSU SMSU Room 333

8:00 AM – 10:00 AM

Welcome and Plenary Session

PSU SMSU Ballroom

12:00 PM – 1:00 PM

**Knowledge Café: Developing
Inclusive Urban Wildlife Research
Workshop**

PSU SMSU Room 238

12:00 PM – 1:00 PM

**What Bats are in my Beltway
Workshop?**

PSU SMSU Room 296/298

1:00 PM – 5:00 PM

**Restoring And Conserving Urban
Waterways**

PSU SMSU Room 338

6:00 PM – 9:00 PM

Poster Session

PSU SMSU Ballroom



Tuesday, June 4

8:00 AM – 4:00 PM	Registration	PSU SMSU Room 333
12:00 PM – 1:00 PM	Adding Bioacoustics To Your Tool Kit Workshop	PSU SMSU Room 338
12:00 PM – 1:00 PM	SciCats: Tools For Communicating Science Effectively Workshop	PSU SMSU Room 296/298
6:00 PM – 9:00 PM	Evening Social and Urban Wildlife Working Group Meeting	Oregon Museum of Science and Industry (OMSI), 1945 SE Water Ave, Portland

Wednesday, June 5

8:00 AM – 3:30 PM	Registration	PSU SMSU Room 333
8:00 AM – 12:00 PM	Implementing And Applying Research To Management Of Urban Deer Workshop	PSU SMSU Room 338
12:00 PM – 2:30 PM	Wild Urban Parrots Workshop	PSU SMSU Room 338
3:40 PM	Closing Plenary	PSU SMSU Room 327/8/9

Welcome Social

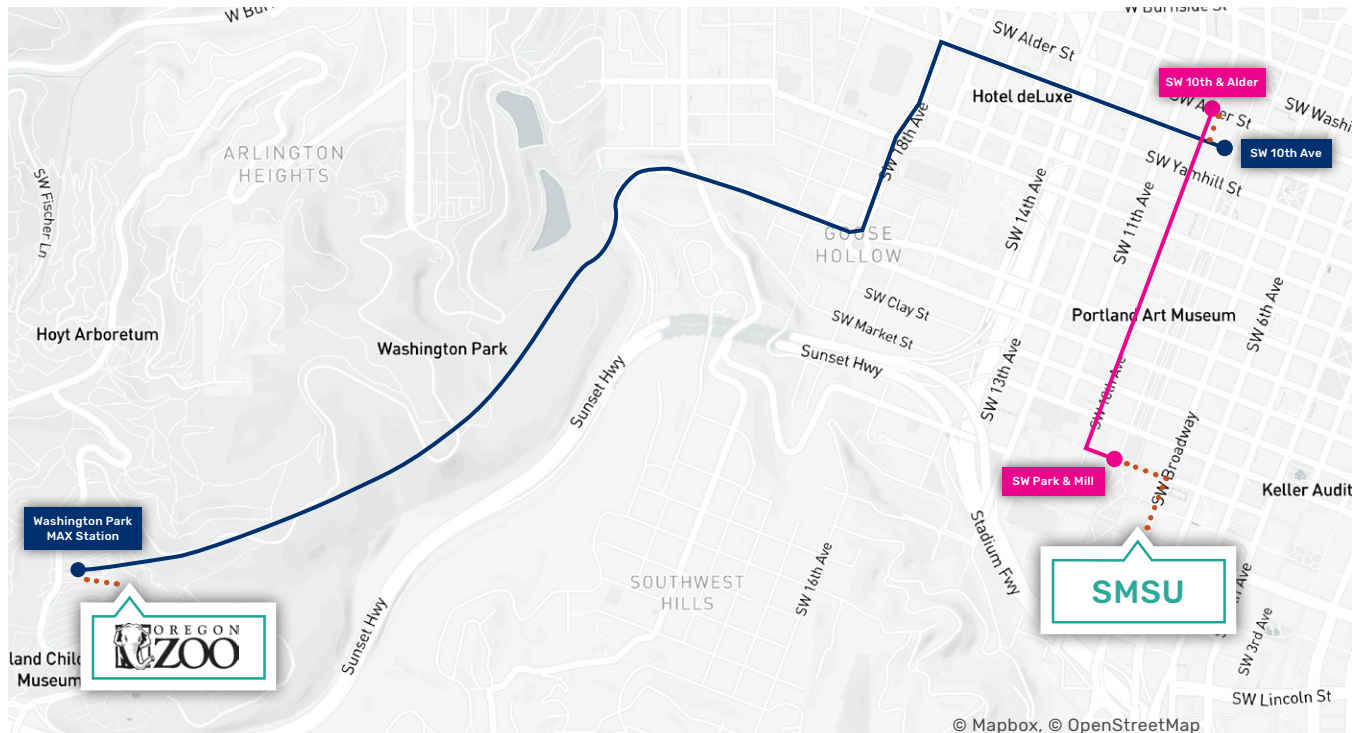


OREGON ZOO
Sunday, June 2
6:00 PM – 9:00 PM

Join us on Sunday, June 2nd for a welcome social at the Oregon Zoo! The 64-acre Oregon Zoo is located in Portland, a city and surrounding metropolitan area of 2.26 million people. Attendance at the zoo in 2011 exceeded 1.6 million. With ongoing renovations to existing facilities and with every new exhibit or system, the zoo aims to be a model of sustainable conservation of natural resources.

Public Transit Directions

Head to the **SW Park & Mill Bus Stop** which is a 3 minute walk from the Smith Memorial Student Union. Take the **Portland Street Car A Lloyd via Pearl** for 4 stops to **SW 10th & Alder Station**. Then take the **MAX Blue Line towards Hillsboro** for 4 stops to **Washington Park MAX Station**. The Oregon Zoo is within 3 minutes walking distance from the MAX Station. The commute should take about 30 minutes, varying by traffic.



Plenary Session

Monday, June 3

8:00 AM – 10:00 AM

SMSU Ballroom

COLLABORATION & CONSERVATION: APPLICATIONS TO URBAN WILDLIFE

IT'S ALL CONNECTED: WILDLIFE, PEOPLE, AND THE INTERSECTIONALITY OF SOCIO-ENVIRONMENTAL SYSTEMS



Dr. Christopher J. Schell

Assistant Professor of Urban Ecology, University of Washington, Tacoma

Dr. Chris Schell is an urban ecologist whose research integrates evolutionary theory with ecological application to disentangle the processes accentuating human-carnivore conflict. Specifically, Chris' interests lie in understanding the physiological mechanisms and anthropogenic drivers that bolster may contribute to fearless behavior in urban carnivores. His research is uniquely tied to the community: urban ecology is inherently a synergy of anthropogenic forces and natural processes. Hence, he often works closely with nondominant communities (e.g. ethnic and racial minorities), wildlife managers, cultural institutions, and philanthropic organizations to help foster mutually enriching relationships among people and wildlife. Concurrently, he strives to increase representation and affect positive change in STEM. Chris received his B.A. in Psychology from Columbia University (2009) and his masters and Ph.D in Evolutionary Biology from the University of Chicago (2015). Since joining the faculty in the School of Interdisciplinary Arts and Sciences at the University of Washington, Tacoma, Chris has launched the Grit City Carnivore Project, a research collaborative among the Point Defiance Zoo & Aquarium and Metro Parks Tacoma to uncovering the patterns and processes by which wildlife are adapting to cities. Together with his collaborators, Chris works to connect local and national communities with wildlife while simultaneously working to uncover the mechanisms that drive urban adaptation in wildlife.

Plenary Session

Monday, June 3
8:00 AM – 10:00 AM
SMSU Ballroom

COLLABORATION & CONSERVATION: APPLICATIONS TO URBAN WILDLIFE

EQUITY AND CULTURE CHANGE IN CONSERVATION: IT'S COMPLICATED



Deeohn Ferris, JD
Vice President for Equity, Diversity and Inclusion at the National Audubon Society

Deeohn Ferris, JD, is Vice President for Equity, Diversity and Inclusion at the National Audubon Society. Deeohn is an environmental lawyer whose career connects many fields of study and spans government, industry, the public interest and the civil rights sectors. She has extraordinary experience leading expert teams working on community regeneration and land revitalization with federal agencies, as well as governments, foundations, community coalitions, tribal organizations and indigenous peoples in the US and countries on five continents. Deeohn is an internationally recognized provider of specialized know-how that tackles equity, sustainability and resiliency, as well as inclusion, engagement and investments that benefit under-represented, often, racially and economically stratified populations. Her mission is building the capacity of cross-disciplinary stakeholders to understand and implement equity best practices and strategies, shaping approaches and partnerships that ensure the inclusion of diverse and informed community perspectives, and securing health and the benefits of nature for every neighborhood. Deeohn is a popular speaker, she is the recipient of many professional achievement awards, and her public service involves numerous federal committees and boards.

SOUVLAKI COYOTE: THE CHALLENGE OF BUILDING AN INCLUSIVE CULTURE OF WILDLIFE CONSERVATION ON THE URBAN LANDSCAPE



Bob Sallinger
Director of Conservation at Audubon Society of Portland

Bob Sallinger serves as the Conservation Director for the Audubon Society of Portland where he has worked since 1992. As Conservation Director, Bob directs Portland Audubon's policy and advocacy initiatives, litigation, community science programs, and its Wildlife Care Center which treats over 3,000 wild animals each year. Bob has also served as an adjunct professor of law at Lewis and Clark Law School, is on several boards of directors and was an elected director at the East Multnomah Soil and Water Conservation District for more than a decade. Bob learned his love of conservation and nature from growing up roaming the woods of New England and on long distance hikes on the Pacific Crest and Continental Divide Trails. He has a BA from Reed College and a JD from Lewis and Clark Law School. He currently lives in NE Portland with his wife Elisabeth, three children, dogs, goats and other assorted critters. Audubon Society of Portland was founded in 1902 to inspire people to love and protect nature.

Monday, June 3rd | 1:40 PM - 4:40 PM

CONFERENCE SESSIONS

8:00 AM	WELCOME & PLENARY (Ballroom)	
10:00 AM	Break (Ballroom)	
Time	Concurrent Session 1 ROOM 238	Concurrent Session 2 ROOM 294
Concurrent Sessions	USING MULTI-CITY COLLABORATIONS TO ADVANCE GLOBAL URBAN BIODIVERSITY Moderator: Maureen Murray	FROM PLANNING TO POP CULTURE: EFFECTIVE STRATEGIES FOR MAKING CITIES WILD Moderator: Kat Superfisky
10:30 AM	Effects of urbanization on native bird assemblages in three southwestern US cities Presenter: Katti	Connecting people to connectivity: From celebrity cats to eco-hip hop Presenter: Pratt
10:50 AM	The Urban Wildlife Information Network: Moving towards a global dataset for urban wildlife Presenter: Magle	Symbiotic cities: Reimagining urban infrastructure as an opportunity for, rather than impediment to, wildlife connectivity Presenter: Superfisky
11:10 AM	Collaborating across political boundaries: Conserving wildlife habitat in the greater Portland, Oregon metropolitan region Presenter: Hennings	Connecting Wildlife in Urbanized Los Angeles Presenter: Pallini-Tipton
11:30 AM Lunch (on your own)	12:00 PM to 1:00 PM WORKSHOP KNOWLEDGE CAFÉ: DEVELOPING INCLUSIVE URBAN WILDLIFE RESEARCH	
Concurrent Sessions	USING MULTI-CITY COLLABORATIONS TO ADVANCE GLOBAL URBAN BIODIVERSITY (continued) Moderator: Maureen Murray	COMMUNITY SCIENCE Moderator: Jason Luscier
1:00 PM	Connecting cities and biodiversity resources through the Urban Biodiversity Hub Presenter: Pierce	Foraging behaviours in urban smooth-coated otters in Singapore Presenter: Johns
1:20 PM	The UrBioNet Research Coordination Network: New perspectives on theory and practice of urban biodiversity Presenter: Nilon	iNaturalist can guide policy: examples in Dallas/Fort Worth Presenter: Kieschnick

All sessions are held at SMSU (Smith Memorial Student Union)

7:00 AM to 5:00 PM Registration Open (Room 333)

Morning coffee 7:30 AM (Ballroom)



10:00 AM Break (Ballroom)		
Time	Concurrent Session 3 ROOM 296/8	Concurrent Session 4 ROOM 327/8/9
Concurrent Sessions	URBAN HAZARDS FOR BIRDS AND WILDLIFE Moderator: Mary Coolidge	CATS AND WILDLIFE Moderator: Bob Sallinger
10:30 AM	Evaluating solutions to bird mortality from collisions with glass Presenter: Sheppard	Cats safe at home: An innovative program for protecting birds and cats in Portland, Oregon Presenter: Sallinger
10:50 AM	Bird window collisions in Portland OR: case study and policy Presenter: Helzer	Catio tour: A humane and effective strategy for protecting birds and cats Presenter: Kraus
11:10 AM	Shedding light on the growing issue of ecological light pollution Presenter: Coolidge	Humane reduction of free-roaming cats on Hayden Island: A case study Presenter: Liebezeit
11:30 AM Lunch (on your own)	12:00 PM to 1:00 PM WORKSHOP WHAT BATS ARE IN MY BELTWAY?	
Concurrent Sessions	URBAN BATS Moderators: Liza Lehrer and Han Li	CATS AND WILDLIFE (continued) Moderator: Bob Sallinger
1:00 PM	Comparing biotic and anthropogenic drivers of bat species distributions in Chicago: water, forest, buildings, and noise Presenter: Lehrer	Cats and wildlife: Integrating conservation and animal welfare perspectives Presenter: Bays
1:20 PM	Evaluating relationships between bats and urban landscapes Presenter: Pederson	Engaging with veterinarians on cat management strategies to reduce cat overpopulation and cat impacts on wildlife populations Presenter: Luszcz

**1:00 PM to 5:00 PM
WORKSHOP, ROOM 338
RESTORING AND CONSERVING
URBAN WATERWAYS**

Monday, June 3rd | 1:40 PM - 4:40 PM

CONFERENCE SESSIONS

Time	Concurrent Session 1 ROOM 238	Concurrent Session 2 ROOM 294
1:40 PM	Discussion	Community science with cat tracker: A smartphone app for understanding an ecological CATastrophe Presenter: Luscier
2:00 PM	Break (Ballroom) 	
Concurrent Sessions	INCLUSIVE URBAN ECOSYSTEMS: INTEGRATING URBAN ECOLOGY RESEARCH WITH COMMUNITY ENGAGEMENT Moderators: Chris Schell and Travis Gallo	URBAN GARDEN ECOLOGY Moderators: Hailey Wallace and Marion Dresner
2:30 PM	Science takes flight: Evolutionary ecology of feral pigeons and community engagement Presenter: Carlen	Ecological characteristics of bee communities in urban gardens Presenter: Langellotto
2:50 PM	Michigan ZoomIN: Partnering with the public to study Michigan's carnivore guild Presenter: Harris	Backyard vegetation and arthropod abundance Presenter: Dresner
3:10 PM	Conducting urban ecology research on private property Presenter: Dyson & Fuentes	Are we providing for bees in our neighborhoods? Assessing the relationship between small scale vegetation metrics and pollinator visitation in SE Portland Presenter: Wallace
3:30 PM	Break (Ballroom) 	
Concurrent Sessions	INCLUSIVE URBAN ECOSYSTEMS: INTEGRATING URBAN ECOLOGY RESEARCH WITH COMMUNITY ENGAGEMENT (continued) Moderators: Chris Schell and Travis Gallo	URBAN GARDEN ECOLOGY (continued) Moderators: Hailey Wallace and Marion Dresner
3:40 PM	Wild in Seattle: Using community science, high-tech reporting tools, and community engagement to increase human-wildlife coexistence in the greater Seattle area Presenter: Remine, Long & Jordan	The influence of neighborhood landscape characteristics on native bird communities. Implications for increasing biodiversity in our yards Presenter: Vermeulen
4:00 PM	Birds, vacant lots, and environmental justice Presenter: Nilon	Investigating the attractiveness of native wildflowers to pollinators and natural enemies Presenter: Anderson
4:20 PM	Hotspots and blindspots: How community science can perpetuate environmental justice Presenter: Perkins	Discussion

Time	Concurrent Session 3 ROOM 296/8	Concurrent Session 4 ROOM 327/8/9
1:40 PM	Discussion	The DC Cat Count Presenter: Boone
2:00 PM	Break (Ballroom) ☕	
Concurrent Sessions	URBAN BATS (continued) Moderators: Liza Lehrer and Han Li	URBAN COYOTES Moderator: Paula-Marie Lewis
2:30 PM	White-nose Syndrome impacts to bat communities along a rural-urban gradient Presenter: Deeley	Species richness within an urban coyote (Canis latrans) territory in Atlanta, Georgia Presenter: Mowry
2:50 PM	The luxury effect beyond cities: bats responded to socioeconomic variations across landscapes Presenter: Li	Urbanization and its effects on resource use in coyotes in Southern California Presenter: Larson
3:10 PM	Non-traditional partnership to conserve urban bat species and promote science literacy in the North Carolina Piedmont Presenter: Zarecky	Consumption of free-roaming cats by coyotes in southern California Presenter: Martinez
3:30 PM	Break (Ballroom) ☕	
Concurrent Sessions	URBAN BATS (continued) / URBAN BIRDS Moderators: Liza Lehrer and Han Li	URBAN COYOTES (continued) Moderator: Paula-Marie Lewis
3:40 PM	NHMLA Backyard Bat Survey: New strategies in urban bat research and outreach Presenter: Ordeñana	Evaluating human-coyote encounters in an urban landscape using iNaturalist Presenter: Drake
4:00 PM	Indicator communities for songbird conservation in heterogeneous urban landscapes Presenter: Sander	Mesopredator occurrence and distribution in an urban environment in the southern high plains of Texas Presenter: Carter
4:20 PM	Public street-tree preferences by birds in the Los Angeles urban forest: the influence of tree origin and socioeconomics Presenter: Wood	Fostering relationships to study relevant questions in underserved urban areas: Coyotes and Huston Tillotson University Presenter: Conrad Simon

Poster Session



PORTLAND STATE UNIVERSITY
Smith Memorial Student Union Ballroom
6:00 PM to 9:00 PM

Join us at the Poster Session for hors d'oeuvres and a no host bar.

Poster title

Author(s)

The Effects of Urban Noise Pollution on Bat Echolocation and Habitat Suitability in Syracuse NY	Alexandra Sheehan, Jason Luscier
The Safe Wildlife Crossings Design for the Interstate 15 Freeway	Ali Monajjemi, Elena Pierce
Assessment of Helminth Biodiversity in Los Angeles County Coyotes (<i>Canis latrans</i>)	Amanda F. Tokuyama, Sarah K. Helman, Justin L. Brown, Seth P. D. Riley, Jamie Lloyd-Smith
Multiple Values of Urban School Gardens	Amy Goodall
The Indirect Effects of Habitat Fragmentation on Squamate Species Richness in Southern California	Andrew Powers, Tim J. Karels
Urban Green Jays: Habitat Use in the Lower Rio Grande Valley	Anthony Henehan, Richard Heilbrun, Jason Estrella
Ecology and Conservation of the Wildlife Community in Utah's Wasatch Mountains Along a Wildland-Urban Interface: A Citizen Science Approach	Austin Green, Mary Pendergast, Lisa Thompson, Lewis Kogan, Cagan Sekercioglu
Pelecanus: Conservation Conversations	Austin Parker
Does ecological restoration break a feedback loop between birds and invasive plants, promoting regeneration in urban woodlands?	Bradley Simpson, Lea R. Johnson
Conflicts between humans and birds of prey in Sao Paulo, Brazil: An 11-year retrospective study.	Bruno Petri, Haroldo Furuya, Lilian S. Fitorra, Valeria Pedro, Fabio Toledo, Liliane Milanelo
Reviewing the past, present and potential lizard faunae of New Zealand cities	Christopher Woolley, Stephen Hartley, Danielle Shanahan, Nicola Nelson
From Prison to Habitat - Engaging Incarcerated Volunteers in a Lake Restoration Project	Diana Foss
Effective use of Carbon Monoxide (CO) to control ground squirrel and gopher populations	Duane Titus
The invasion ecology of ivy in Portland's Forest Park	Eric Butler

Poster title

Author(s)

Intraguild interactions within carnivores in Detroit Metro Parks	Gabriel Gadsden, Rumaan Malhotra, Nyeema C. Harris
Determining the Prevalence of <i>Toxoplasma gondii</i> in the Syracuse Urban Deer Population	Gabriella Oliva, Jason Luscier, Emily Ledgerwood
Urbanization exacerbates the decline of white-nose syndrome affected bat species	Han Li, Kevin A. Parker Jr., Matina C. Kalcounis-Rueppell
Daily activity patterns of relocated urban rhesus macaques (<i>Macaca mulatta</i>) in a human-dominated landscape, Delhi and its implication in management	Ishita Ganguly, Netrapal Singh Chauhan
Estimating Urban Parrot Populations and Determining Landscape Characteristics of Roosts in Southern California	Janel L. Ortiz
Under-representation of community approaches in the study of urban small mammals	Jeffrey D. Haight, Sharon J. Hall, Jesse S. Lewis
Phylogenetic analysis of the canine distemper viral strains circulating in Ontario wildlife	Jolene Giacinti, David Pearl, Davor Ojkic, Claire Jardine
Incidental Sightings Map Projects: Tools for Research and Outreach	Joshua Mills, Zuriel van Belle, Megan Draheim
Individual Differences in a Foraging Extraction Task of Urban Long Tailed Macaques (<i>Macaca fascicularis</i>)	Josephine Hubbard
Carnivore population structure across an urbanization gradient: A regional genetic analysis of bobcats in southern California	Julia G. Smith, Megan K. Jennings, Erin E. Boydston, Kevin R. Crooks, Holly B. Ernest, Seth P. D. Riley, Laurel E. K. Serieys, Shaelynn Sleater-Squires, Rebecca L. Lewison
Education & Bylaw Enforcement to Reduce Human-Bear Conflict – Review of the City of Coquitlam’s Urban Wildlife Program	Julie Kanya
Migratory songbird richness on military training lands in interior Alaska -where increasing access development might have the greatest impact	Justin Smith, Garrett Savory, Kim Jochum
Bird community on office developments is explained by development and landscaping actions impacting vegetation communities	Karen Dyson
Effects of Mammalian Aposematic Pattern and Contrast Variation on Predator Avoidance Learning	Kathy Vo, Theodore Stankowich
Evenness of Bird Species along a Residential Gradient in Wake County, North Carolina	Kolby Altabet, Madhusudan Katti
Resource Selection of Urban Red Foxes (<i>Vulpes vulpes</i>) in Lincoln, NE	Kyle Dougherty, John Benson, Elizabeth VanWormer
Effects of light pollution on populations of gray treefrogs and green frogs in Syracuse, NY.	Kylee B. Wilson, Jason D. Luscier

Poster Session

Poster title

Author(s)

Avian Community Dynamics in an Urban Forest Fragment in Central New York

Margaret Valentine, Rachael Miller, Donald McCrimmon Jr., Jason Luscier

Connectivity among populations of Pacific treefrogs (*Pseudacris regilla*) in the Portland Metropolitan area

Marissa Eckman, Rylee Trendell, Katie Holzer, Lauren Chan

Can rapid evolution of pollution tolerance help conserve amphibians in Pacific northwest urban storm water facilities?

Max R. Lambert

A Wildlife Exclusion Service (AWES)

Michael McGuire, Doris Duncan

Filling in Data Gaps with Citizen Science and BioBlitz Events

Miguel Ordeñana, Lila Higgins, Richard Smart

Continuous time movement models and home range size: ecological advances in space use between urban and rural black bears

Nicholas P. Gould, Roger A. Powell, Roland W. Kays, Colleen Olfenbuttel, Christopher S. DePerno

Preliminary acoustic surveys of bats in Portland's urban parks

Pamela Thompson, Olyssa Starry, Kevina Vulinec

Coyote Management Plans at Face Value

Paula-Marie Lewis

Monkey beetles in the city – Examining species composition along urbanisation gradients in Cape Town, South Africa

Peta Brom, Les Underhill, Jonathan Colville and Kevin Winter

Effective No-Poison Rodent Control

Rebecca Dmytryk

Spatio-temporal Patterns of Brown Rat and Free-Roaming Cat Populations in the City of Chicago

Ríos María Jazmín, Magle Seth B., LaMontagne Jalene M.

Cat management preferences of feral cat & wild bird advocates in the USA: where stakeholders agree and disagree

Sabrina Aeluro

Identifying spatial patterns of gene flow in Blainville's horned lizard (*Phrynosoma blainvillii*) in an urban landscape

Sarah M. Wenner, Jeanne M. Robertson, Katy S. Delaney

Human-carnivore co-occurrence patterns in Detroit Metro Parks

Siria Gamez, Rumaan Malhotra, Nyeema Harris

Poster title

Author(s)

Connecting the community of West Linn to natural processes through the Parks & Rec program Beaver Ambassadors

Steven Murschel

Towards post-species spaces

Trace Fleeman y Garcia


Species identification through 16SrRNA analysis in wildlife forensics

Varuna P. Panicker, Athira N, Binoy C Babu, Jacob Alexander



Tuesday, June 4th | 9 AM - 11:30 AM


CONFERENCE SESSIONS

Time	Concurrent Session 2 ROOM 294	Concurrent Session 3 ROOM 296/8
Concurrent Sessions	RESEARCH FROM THE URBAN WILDLIFE INFORMATION NETWORK Moderator: Cria Kay	URBAN RAPTORS AND OTHER BIRDS Moderator: Lois Balin
9:00 AM	A city's size and proportion of green space affects mammalian relative occupancy rates and response to urbanization: An analysis of nine cities across the United States Presenter: Fidino	Nest site characteristics of Red-tailed Hawks in New York City Presenter: Toal
9:20 AM	Urban wildlife conservation in the US corn belt: Mesopredators and their relationship to the urban environment in a small agricultural city Presenter: MacDougall	Seattle's adaptable urban Cooper's Hawks Presenter: Deal
9:40 AM	Staying connected: Do artificial corridors in cities positively impact urban carnivore occurrence? Presenter: Schell	Urban breeding raptors in Ensenada, Baja California, México Presenter: Toscano
10:00 AM	Break (Room 333) 	
Concurrent Sessions	RESEARCH FROM THE URBAN WILDLIFE INFORMATION NETWORK (continued) Moderator: Cria Kay	URBAN RAPTORS AND OTHER BIRDS (continued) Moderator: Lois Balin
10:30 AM	Using cameras to understand wildlife patterns in a mid-sized American city Presenter: Drake	Burrowing owl off-grid video monitoring system: Lessons learned Presenter: Balin
10:50 AM	An overview of the wildlife of Indianapolis, IN (USA) along the urban to rural gradient Presenter: Ryan	The response of an urban-exploiting raptor to development intensity in the suburban landscape Presenter: White Rose
11:10 AM	Camera trap and community science observation data paired with landscape resistance modeling identifies major urban wildlife corridors Presenter: Katrak-Adefowora	Discussion

All sessions are held at SMSU (Smith Memorial Student Union)


8:00 AM to 4:00 PM Registration Open
Morning coffee 8:00 AM (Room 333)




Time	Concurrent Session 4 ROOM 327/8/9	Concurrent Session 1 ROOM 338
Concurrent Sessions	FERTILITY CONTROL TO MITIGATE HUMAN-WILDLIFE CONFLICTS Moderator: Stephanie Boyles Griffen, Monique Principi	HOW THE CHANGING URBAN LANDSCAPE REQUIRES A CHANGE IN WILDLIFE DISEASE MONITORING AND MANAGEMENT Moderator: Jennifer Murrow
9:00 AM	Urban deer population management with PZP: State of the art <small>Presenter: Rutberg</small>	Strategy to understand new viral species in wildlife <small>Presenter: Goldstein</small>
9:20 AM	A role for fertility control in the management of suburban kangaroo populations in Australia <small>Presenter: Herbert</small>	The Tick Lick: improving host targeted baited tick treatment for public and private use. <small>Presenter: Hummell</small>
9:40 AM	Macaque contraceptive programme in Hong Kong <small>Presenter: Shek</small>	Discussion
10:00 AM	Break (Room 333) 	
Concurrent Sessions	FERTILITY CONTROL TO MITIGATE HUMAN-WILDLIFE CONFLICTS (continued) Moderators: Stephanie Boyles Griffen, Monique Principi	HOW THE CHANGING URBAN LANDSCAPE REQUIRES A CHANGE IN WILDLIFE DISEASE MONITORING AND MANAGEMENT (continued) Moderator: Jennifer Murrow
10:30 AM	A new competitor in the urban rat race <small>Presenter: Pyzyna</small>	Host-targeted tick control to reduce the risk of tick bite and Lyme disease in a suburban environment <small>Presenter: Li</small>
10:50 AM	Management of urban black-tailed prairie dog populations using non-lethal reproductive control <small>Presenter: Runte</small>	Blacklegged tick reservoir host diversity and abundance impacts on dilution of <i>Borrelia burgdorferi</i> in residential and woodland habitats in Connecticut, USA <small>Presenter: Linske</small>
11:10 AM	Discussion	Discovery of an established population of <i>Amblyomma americanum</i> in southwestern Connecticut <small>Presenter: Williams</small>

Tuesday, June 4th | 11:30 AM - 3:10 PM

CONFERENCE SESSIONS

Time	Concurrent Session 2 ROOM 294	Concurrent Session 3 ROOM 296/8
11:30 AM Lunch (on your own)		12:00 PM to 1:00 PM WORKSHOP SCICATS: TOOLS FOR COMMUNICATING SCIENCE EFFECTIVELY
Concurrent Sessions	RESEARCH FROM THE URBAN WILDLIFE INFORMATION NETWORK (continued) Moderator: Cria Kay	URBAN DEER Moderator: Jason Boulanger
1:00 PM	Urban wildlife from parklands to downtown Los Angeles. Presenter: Brown	Using research as the driver for management of urban white-tailed deer at Fort Drum, NY Presenter: Feehan
1:20 PM	Discussion	Lessons learned from a decade of urban deer management in a university setting Presenter: Curtis
1:40 PM	No talk scheduled	Choosing appropriate metrics to assess success and failure of white-tailed deer management – not just in suburbia Presenter: Blossey
2:00 PM	Break (Room 333) 	
Concurrent Sessions	POLLINATORS, INSECTS AND MUSSELS Moderator: Jessica Alderson	URBAN DEER (continued) Moderator: Jason Boulanger
2:30 PM	Operation Checkerspot: The return of a missing butterfly to the Presidio of San Francisco Presenter: Harelson	Experiences from a 20-year deer management program in Cleveland Metroparks Presenter: Cepek
2:50 PM	The boom and bust butterfly: Finding a way for the quino checkerspot Presenter: Howorth	Urban deer population control: different options for different locations Presenter: Bechert

Time	Concurrent Session 4 ROOM 327/8/9	Concurrent Session 1 ROOM 338
11:30 AM Lunch (on your own)		12:00 PM to 1:00 PM WORKSHOP ADDING BIOACOUSTICS TO YOUR TOOL KIT
Concurrent Sessions	URBAN HABITAT CONNECTIVITY Moderator: Leslie Bliss-Ketchum	HOW THE CHANGING URBAN LANDSCAPE REQUIRES A CHANGE IN WILDLIFE DISEASE MONITORING AND MANAGEMENT (continued) Moderator: Jennifer Murrow
1:00 PM	Connectivity assessment and planning in dynamic urban systems: The Metro Habitat Connectivity Toolkit <i>Presenter: Bliss-Ketchum</i>	Disease spillover among wildlife species: Has anthropogenic landscape change contributed to the rise of sarcoptic mange in Pennsylvania black bears? <i>Presenter: Greenberg</i>
1:20 PM	Devising urban connectivity models for the northern red-legged frog (<i>Rana aurora</i>) <i>Presenter: Temple</i>	Measures of fitness in avian populations as a measure of one health <i>Presenter: Murrow</i>
1:40 PM	Genetic diversity and connectivity of the northern red-legged frog in an urbanized landscape <i>Presenter: Chan</i>	Spatial analysis of white-tailed deer (<i>Odocoileus virginianus</i>) movements in conjunction with integrated pest management treatments in a suburban landscape <i>Presenter: Roden-Reynolds</i>
2:00 PM	Break (Room 333) 	
Concurrent Sessions	URBAN HABITAT CONNECTIVITY (continued) Moderator: Leslie Bliss-Ketchum	PLANNING, POLICY AND MANAGEMENT Moderator: Melissa Rowe Soll
2:30 PM	Animal Road Crossings: Reconciling Human and Animal Mobility in Urbanizing Landscapes <i>Presenter: Jacobson</i>	Protecting nesting birds: An MBTA compliance strategy for city government <i>Presenter: Helzer</i>
2:50 PM	Wildlife-vehicle conflict: Automated reporting and hotspot analysis <i>Presenter: Shilling</i>	Cities need urban wildlife plans <i>Presenter: Ndayishimiye</i>

Tuesday, June 4th | 3:10 PM - 4:40 PM

CONFERENCE SESSIONS

Time	Concurrent Session 2 ROOM 294	Concurrent Session 3 ROOM 296/8
3:10 PM	Local and landscape scale variables shape insect diversity in an urban environment Presenter: Adams	Discussion
3:30 PM	Break (Room 333) 	
Concurrent Sessions	POLLINATORS, INSECTS AND MUSSELS (continued) Moderator: Jessica Alderson	URBAN DEER (continued) Moderator: Jason Boulanger
3:40 PM	Characteristics of native freshwater mussel shoals in a large river: Can vulnerable populations thrive in urbanized reaches? Presenter: Searles Mazzacano	Influence of coyotes (<i>Canis latrans</i>) on the white-tailed deer (<i>Odocoileus virginianus</i>) population and behavior in a suburban forest preserve Presenter: Anchor
4:00 PM	Reintroducing a native freshwater mussel to an urban lake Presenter: Young	Discussion
4:20 PM	Discussion	No talk scheduled



Evening Social & Urban Wildlife Working Group Meeting

6:00 - 9:00 PM

More info on the next page

All sessions are held at SMSU (Smith Memorial Student Union)

Time	Concurrent Session 4 ROOM 327/8/9	Concurrent Session 1 ROOM 338
3:10 PM	Traffic noise and light reduce the efficacy of wildlife crossing structures <small>Presenter: Collins</small>	No talk scheduled
3:30 PM	Break (Room 333) 	
Concurrent Sessions	URBAN HABITAT CONNECTIVITY (continued) <small>Moderator: Leslie Bliss-Ketchum</small>	URBAN MAMMALS <small>Moderator: Lauren Chan</small>
3:40 PM	The power of partnerships: Building the largest wildlife crossing in the world <small>Presenter: Pratt</small>	Female bobcat social organization in a fragmented urban landscape: high overlap for close relatives. <small>Presenter: Reily</small>
4:00 PM	Backyard Habitat Certification Program <small>Presenter: West & Peterson</small>	Assessing mammal communities in an arid urban preserve using a novel functional trait approach <small>Presenter: Weiss</small>
4:20 PM	No talk scheduled	Spatial ecology of urban striped skunks (<i>Mephitis mephitis</i>) in the Northern Great Plains <small>Presenter: Boulanger</small>

Evening Social & Working Group Meeting



OMSI
Tuesday, June 4
6:00 PM -9:00 PM

Join us on Tuesday, June 4th at the Oregon Museum of Science and Industry (OMSI) for snacks and drinks while we enjoy good times and explore Turbine hall and the Physics lab. OMSI serves over 1 million visitors at the museum and through off-site education programs. OMSI is ranked as one of the top science centers in the United States and has an international reputation for its innovative exhibits and educational programs.

Public Transit Directions

Head to the **SW 5th & Harrison Bus Stop** which is a 4 minute walk from the Smith Memorial Student Union. Take the **Bus 9 Powell Blvd/Gresham TC** for 6 stops to **OMSI/SE Waterfront**. OMSI is within 5 minutes walking distance from the MAX Station.





Wednesday, June 5th | 9:00 AM - 10:50 AM


CONFERENCE SESSIONS

Time	Concurrent Session 1 ROOM 26	Concurrent Session 2 ROOM 238	Concurrent Session 3 ROOM 294
Concurrent Sessions	ETHICAL WILDLIFE CONTROL Moderator: Lauren Chan	(Sessions in this room begin at 1 PM)	HUMAN-WILDLIFE INTERACTIONS Moderator: Sarah Grimké Aucoin
9:00 AM	Barn Owl Maintenance Program (BOMP) Presenter: Duncan		The Cognition of 'Nuisance' Animals Presenter: Benson-Amram
9:20 AM	Predator Exclusion and Education Program (PEEP) Presenter: Jones		Effect of dynamic land use and land cover practices on antelope species in northwestern India Presenter: Bajwa
9:40 AM	Use of bait stations by non-target wildlife as a route of exposure of carnivores to rodenticides Presenter: Burke		No talk scheduled
10:00 AM	Break (Room 333) 		
Concurrent Sessions	RESTORATION FUNDING AND WILDLIFE RESPONSE Moderator: Carol Murdock		HUMAN-WILDLIFE INTERACTIONS Moderator: Sarah Grimké Aucoin
10:30 AM	Not the usual suspects – How to raise \$4 million for restoration Presenter: Murdock		No talk scheduled

All sessions are held at SMSU (Smith Memorial Student Union)

9:00 AM to 3:30 PM Registration Open
Morning coffee 8:00 AM (Room 333)



Time	Concurrent Session 4 ROOM 296/8	Concurrent Session 5 ROOM 327/8/9	Workshops ROOM 338
Concurrent Sessions	URBAN WILDLIFE HEALTH Moderators: Maureen Murray and Kaylee Byers	THE LA URBAN MAMMAL PROJECT: DISEASE, POPULATION GENETICS, AND HUMAN DIMENSIONS Moderator: Christopher Kelty	8:00 AM to 12:00 PM IMPLEMENTING AND APPLYING RESEARCH TO MANAGEMENT OF URBAN DEER
9:00 AM	City Sicker? The relationship between urbanization and wildlife health Presenter: Murray	Wild mammals and their pathogens in Los Angeles County, California Presenter: Helman	
9:20 AM	It's complicated: Understanding the lives of sea otters in Monterey Bay Presenter: Burgess	LA animal stories: Studying online conversations about wildlife to understand emotions, moral commitments, and everyday solutions Presenter: Kelty	
9:40 AM	Host and environmental predictors of antimicrobial resistance in urban mesocarnivores Presenter: Worsley-Tonks	Population genomics of urban mammalian populations in the megacity of Los Angeles based on ddRADseq data Presenter: Byrne	
10:00 AM	Break (Room 333) 		
Concurrent Sessions	URBAN WILDLIFE HEALTH (continued) Moderators: Maureen Murray and Kaylee Byers		
10:30 AM	Red foxes and coyotes in an urban landscape: prevalence and risk factors for disease Presenter: Drake		

Wednesday, June 5th | 10:50 AM - 2:00 PM

CONFERENCE SESSIONS



Time	Concurrent Session 1 ROOM 26	Concurrent Session 2 ROOM 238	Concurrent Session 2 ROOM 294
10:50 AM	Bird response to habitat restoration at a wastewater treatment facility in Oregon, USA Presenter: Liebezeit	(Sessions in this room begin at 1 PM)	Stealing in exchange for food: Spatial position in the group predicts stealing behavior among rhesus macaques (<i>Macaca mulatta</i>) in Shimla, Northern India Presenter: Aiempichitkijkarn
11:10 AM	A study of avian population response after habitat restoration using remote sensing and community science bird observation data Presenter: Sivakumar		No talk scheduled
11:30 AM	Lunch (on your own)		
Concurrent Sessions	REPTILES AND AMPHIBIANS Moderator: Gregory Pauly	URBAN BIODIVERSITY Moderator: Richard Heilbrun	HUMAN-WILDLIFE INTERACTIONS Moderator: Sarah Grimké Aucoin
1:00 PM	Where lawn may as well be lava: The low habitat value of lawn for herpetofauna inhabiting urban parklands in Los Angeles Presenter: Pauly	Transforming vacant lots into climate resilient pollinator habitat Presenter: Schrass	Conflict or coexist? Presenter: Bandyopadhyay
1:20 PM	California red-legged frogs reintroduced to the largest urban National Park in the U.S. Presenter: Semple Delaney	Retrofitting ecology into the urban environment Presenter: Marlowe	Factors influencing intraspecific variation in female black bear behavior in the human-dominated landscape Presenter: Hardeman Jr.
1:40 PM	Citizen science observations provide unique insight into salamander distributions within urban environments Presenter: Zellmer	BAILA, a novel urban biodiversity assessment framework that combines an urban habitat classification and citizen science data Presenter: Li	Discussion

All sessions are held at SMSU (Smith Memorial Student Union)

Time	Concurrent Session 4 ROOM 296/8	Concurrent Session 5 ROOM 327/8/9	Workshops ROOM 338
10:50 AM	Urban habitat use relates to anthropogenic diet and physiology for the white ibis (<i>Eudocimus albus</i>) in South Florida Presenter: Curry		8:00 AM to 12:00 PM IMPLEMENTING AND APPLYING RESEARCH TO MANAGEMENT OF URBAN DEER (CONTINUED)
11:10 AM	The influence of human land use on the ecology of <i>Baylisascaris procyonis</i> in Ontario, Canada Presenter: French		
11:30 AM	Lunch (on your own)		
Concurrent Sessions	URBAN WILDLIFE HEALTH (continued) Moderators: Maureen Murray and Kaylee Byers	URBAN LARGE CARNIVORES Moderator: Paula-Marie Lewis	12:00 PM to 2:30 PM WILD URBAN PARROTS
1:00 PM	How healthy are city rats? Understanding pathogen prevalence, stress, and rodenticide poisoning across diverse Chicago neighborhoods Presenter: Murray	Not a cakewalk: Insights into movement of large carnivores in human dominated landscapes in India Presenter: Habib	
1:20 PM	Evaluating Small Mammal Health and Community Composition across the Chicago Metropolitan Area Presenter: Mulligan	Living in the Anthropocene: Space-use and movement of Indian grey wolf Presenter: Khan	
1:40 PM	Discussion	21st Century trapping for improved efficacy and ethical considerations Presenter: Martins	

Wednesday, June 5th | 2:00 PM - 4:00 PM



CONFERENCE SESSIONS

Time	Concurrent Session 1 ROOM 26	Concurrent Session 2 ROOM 238	Concurrent Session 2 ROOM 294
2:00 PM	Break (Room 333) 		
Concurrent Sessions	REPTILES AND AMPHIBIANS Moderator: Gregory Pauly	LANDSCAPE RESILIENCY AND RESPONSE TO ALTERED ENVIRONMENTS Moderator: Megan Jennings	COMMUNITY ENGAGEMENT AND PARTNERSHIPS Moderator: Richard Heilbrun
2:30 PM	Investigation of a freshwater turtle mortality event in Fort Worth, Texas Presenter: Richter	Prioritizing connectivity under climate change: uncertainty and opportunity Presenter: Jennings	Bird City Texas: Recognizing meaningful urban wildlife conservation Presenter: Heilbrun
2:50 PM	Dinosaurs in downtown: Alligator snapping turtles thrive in Houston's bayous Presenter: Norrid	Securing refuge patches for tigers in a human-dominated landscape Presenter: Mondal	
3:10 PM	City Snakes: the (Limited) Spatial Ecology & Genetics of Copperheads in an Urban Forest Presenter: Carrasco-Harris	Discussion	
3:30 PM	Break (Room 333) 		
3:40 PM	CLOSING PLENARY (Room 327/8/9)		

Thank you all so much for being a part of this amazing conference. Please join us at the closing plenary to wrap up this great event and start looking forward to the next International Urban Wildlife Conference!



All sessions are held at SMSU (Smith Memorial Student Union)

Time	Concurrent Session 4 ROOM 296/8	Concurrent Session 5 ROOM 327/8/9	Workshops ROOM 338
2:00 PM	Break (Room 333) 		12:00 PM to 2:30 PM WILD URBAN PARROTS (continued)
Concurrent Sessions	ENVIRONMENTAL AND PUBLIC EDUCATION Moderator: Matt Mulligan	URBAN LARGE CARNIVORES Moderator: Paula-Marie Lewis	
2:30 PM	What's that bug? Connecting knowledge to stated conservation behaviors of urban students Presenter: Cornelisse	Survival and competing mortality risks for mountain lions in the greater Los Angeles area Presenter: Benson	
2:50 PM	Urban wildlife conservation in practice Presenter: Dillon	Mountain lions in our backyard: Conflicts with people and response to fire in Los Angeles Presenter: Sikich	
3:10 PM	Discussion	Poisoned chalice? A multi-method approach to testing the effects of urbanisation on the foraging ecology of Cape Peninsula caracal Presenter: Leighton	
3:30 PM	Break (Room 333) 		

Speaker Abstracts & Authors

Abstracts are alphabetized by the first author's last name. Please note that first authors may not have been the person that presented.

*Indicates abstract was accepted, but the author was unable to present.

LOCAL AND LANDSCAPE SCALE VARIABLES SHAPE INSECT DIVERSITY IN AN URBAN ENVIRONMENT.

Benjamin Adams, Urban Nature Research Center, Natural History Museum of Los Angeles County, badams@nhm.org; Enjie Li 2, Urban Nature Research Center, Natural History Museum of Los Angeles County; Brian Brown, Urban Nature Research Center, Natural History Museum of Los Angeles County.

Local community structure is shaped by processes acting at local and landscape scales. Cities exhibit strong but predictable environmental gradients overlaying a mosaic of highly variable but repeated habitat types within a constrained area. Thus, cities present a unique opportunity to explore how both local and landscape factors influence local biotic communities. We used insect communities to examine the interactions among local environmental variables (such as temperature and relative humidity), local habitat characteristics (such as plant community composition), and broad-scale patterns of urbanization (including biophysical, human-built, and socio-economic variables) on local insect abundance, species richness, and species composition in Los Angeles. Insect species richness and abundance were determined by local environmental variables with the higher diversity occurring in drier and hotter sites. In contrast, insect species composition was best predicted by broad-scale urbanization trends, with the more native communities occurring in less urbanized sites and more cosmopolitan insects occurring in highly urbanized sites. However, the presence of native and drought-tolerant plants had the greatest effect on insect communities increasing richness and abundance by >35% and increasing similarity in insect composition across sites, regardless of the degree of urbanization. These results demonstrate that urban insect biodiversity is a product of interacting mechanisms working at both local and landscape scales. However, local scale changes to urban habitats, such as cultivating plants that are adapted to the natural environment nearest the city, can positively impact urban biodiversity regardless of location within the urban matrix.

***IMPACT OF PRIVATE-SECTOR COLLABORATION AS A SUSTAINABILITY TOOL ON CONSERVING BIODIVERSITY IN THE CENTRE OF LAGOS, NIGERIA.**

Solomon Adefolu, Nigerian Conservation Foundation, Lagos, Nigeria, solomon.adeolu@ncfnigeria.org; Yemisi Fawibe, Nigerian Conservation Foundation.

The Lekki Conservation Centre is a protected area in upscale Lagos and can as a biodiversity hotspot in the economic capital of Nigeria. A seventy-eight hectares strict nature reserve with history of protection in the last 28years, is supporting the protection of some rare and endangered species such as Hooded Vulture, African Grey Parrot, Giant Pangolin, etc. One of

the flagship species in the Nature Reserve, the Mona Monkey has sporadically increased in population from a few hundreds to thousands and serving the expectations of teeming tourists for the Centre. Through the biodiversity management of this Reserve, these species and several others such as Bush Bucks, Duiker and Monitor Lizards, have been protected against urban poaching, loss of population due to degradation and deforestation, as well as illegal wildlife trade. Apart of supporting wildlife, the Centre is an ecotourism destination hosting millions of tourists annually from around the world. The Centre established by an environmental NGO -Nigerian Conservation Foundation could not have been sustained without the strong collaborations from private sector organizations like Chevron Nigerian Limited, through its annual Institutional management grant as well the Lagos State Government through her infrastructural development support. The Centre is one of the best conservation efforts in Nigeria and has encouraged other partnerships to collaborate in replicating such in biodiversity hotspots across the country. This research considers the effects of mainstreaming biodiversity into corporate management plans, the impact of collaboration as an effective sustainability tool for protected area management and the success story of the Lekki Conservation Centre. A systematic approach was used to collate primary and secondary data and the results obtained was analyzed to demonstrate the effectiveness of collaboration as a key sustainability tool for urban protected area management while stressing a key fact that conservation without money is conversation.

STEALING IN EXCHANGE FOR FOOD: SPATIAL POSITION IN THE GROUP PREDICTS STEALING BEHAVIOR AMONG RHESUS MACAQUES (MACACA MULATTA) IN SHIMLA, NORTHERN INDIA.

Nalina Aiempichitkijkarn, Department of Population Health & Reproduction, School of Veterinary Medicine, University of California, Davis, CA, USA, Izarecky@greensboroscience.org; Stefano Kaburu, Department of Biomedical Science & Physiology, Faculty of Science & Engineering, University of Wolverhampton, USA; Brianne Beisner, California National Primate Research Center, University of California, Davis, USA; Pascal R. Marty, Department of Population Health & Reproduction, School of Veterinary Medicine, University of California, Davis, USA; Krishna Balasubramaniam, Department of Population Health & Reproduction, School of Veterinary Medicine, University of California, Davis, USA; Eliza Bliss-Moreau, Department of Psychology, University of California, Davis, USA; Brenda McCowan, Department of Population Health & Reproduction, School of Veterinary Medicine, University of California, Davis, USA.

Rhesus macaque (*Macaca mulatta*) is a primate species that is highly adapted to the urban environment, which often leads to frequent conflicts with humans. Here we focus on a rare type of human-macaque interaction where macaques steal inedible objects from humans and return them in exchange for food. More specifically, we examine the individual attributes, namely dominance rank, position in the group, grooming centrality and sex that can explain stealing behavior in a group of rhesus macaques living in the city of Shimla (Northern India). We collected data from July to November 2017 using focal animal sampling, giving a total of 303 hours of observations. We recorded 28 stealing cases from 13 out of 58 adults (22.41%). Our logistic regression reveals that group spatial position significantly predicts the likelihood of engaging in stealing ($p=0.0319$), showing that monkeys who are more peripheral in the group are more likely

Speaker Abstracts & Authors

to engage in stealing behavior. Our work raises the possibility that interactions with people may impose time constraints on the monkeys, as individuals who engage in stealing more frequently might be less prone to seek out opportunities to interact with conspecifics. Alternatively, lower levels of centrality in the group offer individuals fewer opportunities to access anthropogenic food, and thus peripheral monkeys might have developed this stealing and bartering behavior as an alternative foraging strategy. Future work will be needed to understand the factors driving this behavior and management strategy to mitigate the conflict.

INFLUENCE OF COYOTES (CANIS LATRANS) ON THE WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) POPULATION AND BEHAVIOR IN A SUBURBAN FOREST PRESERVE.

Gretchen Anchor, Ohio State University, School of Environment and Natural Resources, Columbus, OHgretchenanchor@gmail.com; Shane McKenzie, Max McGraw Wildlife Foundation, Dundee, IL; Chris Anchor, Forest Preserve District of Cook County, Elgin, IL; Stanley Gehrt, Ohio State University, School of Environment and Natural Resources, Columbus, OH and Max McGraw Wildlife Foundation, Dundee, IL.

In recent decades, white-tailed deer (*Odocoileus virginianus*) and coyotes (*Canis latrans*) have spread into metropolitan and suburban areas in the United States. In the Chicago region, these species share the landscape and have a specific predator-prey relationship. Coyotes in this region rarely hunt adult deer but often prey on fawns. Little is known about how this relationship influences the behavior of deer in suburban areas. This study examined how the predator-prey relationship exhibited in the Chicago region influences the foraging behavior and home range use of deer. We hypothesized that deer antipredator behavior would reflect the actual predation risk. In 2017 and 2018, we used camera traps to record deer behavior at bait stations before and after the introduction of coyote urine near bait blocks. Relocation data of both deer and coyotes was also used during this time to test for avoidance. Although vigilance and cautious behavior while foraging did not change significantly with indication of coyote presence, temporal avoidance of shared spaces was found throughout the study site. We also monitored fawn survival through the use of radio collars ($n = 81$) and coyote diet through scat analysis ($n = 172$) concurrent to the behavior study. Fawn survival was 36.0% with 80.8% of mortalities attributed to coyote predation. The frequency of occurrence of deer remains in coyote scat was found highest in the summer (83.9%) when fawns are present. These results suggest that the antipredator behavior of deer within the Chicago region reflects predation risk.

INVESTIGATING THE ATTRACTIVENESS OF NATIVE WILDFLOWERS TO POLLINATORS AND NATURAL ENEMIES.

Aaron Anderson, Oregon State University, Corvallis, OR, USA, andeaaro@oregonstate.edu; Gail Langellotto, Oregon State University, Corvallis, OR, USA.

Many organizations have published pollinator-friendly planting lists for home gardeners. However, most lists lack empirical evidence to support recommendations. In 2017-2018, we

screened 23 wildflowers native to the Willamette Valley. Plants were selected based upon their potential use in ornamental gardens, as well as anecdotal reports of attractiveness to pollinators. We included four exotic comparators known to be attractive to pollinators. Species were planted in meter-squared plots spaced six meters apart. Between April and October, we monitored pollinator visits and floral bloom phenology. We also sampled insects from plots, weekly. Though this research is ongoing, we have early findings on the attractiveness of these wildflowers to bees. The most attractive plants varied between 2017 and 2018, possibly due to differences in bloom phenology and plant establishment. In 2017, four native wildflower species (*Solidago canadensis*, *Symphyotrichum subspicatum*, *Clarkia amoena* and *Gilia capitata*) were the most attractive flowers for bees, followed by the exotic *Nepeta cataria*. In 2018, three of the top five most attractive plants to bees were exotic garden species. However, this pattern was strongly driven by European honey bee visitation. When we limited our analysis to native bee abundance, the five most attractive wildflowers were all native species. Similarly, across both seasons native wildflowers attracted the highest native bee species richness. This research will continue for a third field season, after which we will publish our own list of pollinator plant recommendations for gardeners in the Willamette Valley region of Oregon.

EFFECT OF DYNAMIC LAND USE AND LAND COVER PRACTICES ON ANTELOPE SPECIES IN NORTHWESTERN INDIA.

Parteek Bajwa, Amity Institute of Forestry and Wildlife, pbajwa@amity.edu; Netrapal Singh Chauhan, Amity Institute of Forestry and Wildlife; D.C. Loshali, Punjab Remote Sensing Centre.

There is an information gap on the biodiversity effects of land use-cover change and dynamics of agrarian landscapes. Such data is essential for policy making and management of species in agro-ecosystems. We therefore investigated the changes in land use and land cover (LULC) of Eco-sensitive zone (ESZ) of the Abohar wildlife sanctuary, India using the spatio-temporal satellite data from 2003 to 2016. Further, the impact of LULC dynamics on the inhabitant antelope species (Nilgai and Blackbuck) was determined through their mortality distribution from 2012 to 2016 in the sanctuary. The land use-cover comparison revealed intensification of cropland area and loss of wasteland habitat throughout the 13 villages comprising of ESZ. The area under cropland witnessed an increased by 3.98% whereas the wilderness area significantly declined by more than 63.15% in a period of fourteen years. Consequently, the spatio-temporal distribution pattern of species mortality was georeferenced and kernel density hotspot analysis revealed that a total of 481 antelopes died during six years. The maximum number of casualties clustered around the regions which observed a significant change in LULC. The results confirmed that the dynamic practices in agrarian landscape have significantly altered the habitat of antelope species. A major cause was infill intensified development and reuse of derelict agricultural fields which caused disturbance in the ecology and habitat use pattern of species. The study suggests that human-wildlife conflict in agricultural landscapes is an increasing concern and the spatio-temporal interaction pattern should be utilized for the mitigation strategies and management in sensitive areas.

Speaker Abstracts & Authors

BURROWING OWL OFF-GRID VIDEO MONITORING SYSTEM: LESSONS LEARNED.

Lois Balin, Texas Parks and Wildlife Department, lois.balin@tpwd.texas.gov; Richard Heilbrun, and Kelly Norrid, Texas Parks and Wildlife Department.

There are many challenges to studying fossorial wildlife species. Ecological and behavioral information about burrowing owls (*Athene cunicularia*) is often partly limited to activities occurring above ground or to the use of underground probes providing live viewing only. We describe an off-grid DVR-based system we created in 2014 to facilitate research and monitor nesting burrowing owls at Rio Bosque Wetlands Park in El Paso, Texas, USA. The system allowed us to view and record burrowing owl activity in their underground burrows and nest boxes. From 2014-2018, we collected high-resolution videos documenting burrowing owl nesting ecology and behavior. Although automated monitoring systems may enhance underground observations, such systems need to be off-grid for research conducted in remote areas. Although our system required major upfront material and labor costs, it required less on-site monitoring than traditional behavioral observations while also providing high quality images of an understudied aspect of burrowing owl nesting ecology. We provide detailed instructions and recommendations for the design, construction, installation, and maintenance of this potentially effective tool.

CONFLICT OR COEXIST?

Kathan Bandyopadhyay, kathan1997@gmail.com.

Human-Wildlife conflict become one of the most serious conservation challenges as well as one of the most recognized health issue in the last few decades. According to the Elisa Distefano –“Human-Wildlife Conflict (HWC) is fast becoming a serious threat to the survival of many endangered species in the world.” But at the same time several different countries without making an in depth analysis just avoid or overlooking the problem which seriously affects the potentially threatened as well as critically endangered species in the world. This conflict is basically manipulated by the Human populations followed by exploitation of the reserve forest and protected areas (PA) results the loss or fragmented habitats of the wild Tigers, Lions, Leopards and elephants and lots of small endemic species. According to the WWF- “Big business also suffers from these conflicts”, as for an example in Riau, Indonesia, the cost of elephant damage to oil palm plantations and timber estates is estimated at around US\$105 million per year. Another interesting study in “Eco-psychosocial Aspects of Human-Tiger Conflict” in Sunderbans (Largest Mangrove delta) in India & Bangladesh suggested that in between the year 2009-2011 a total of 58 incidents of tiger straying have been reported in Sunderbans, 25 % of (nearly US\$8) for the rural and Rs. 439.42(INR) [US\$9] for urban areas per capita per month is the salary and most of the people are stayed below poverty level for years and mainly due to poverty they are bound to enter the man-eating tiger territory every day for honey collection, non-timber forest product collection or prawn collection.

CATS AND WILDLIFE: INTEGRATING CONSERVATION AND ANIMAL WELFARE PERSPECTIVES.

Danielle Bays, The Humane Society of the United States, dbays@humanesociety.org.

How does one reconcile an ethic of wildlife conservation with one of care and protection for domestic cats? The subject of free-roaming, abandoned, and outdoor cat populations doesn't need to be divisive or pit stakeholders in the humane, conservation and scientific communities against one another. Indeed many individuals and organizations engaged in addressing outdoor cats transcend these stakeholder groups and are driven by a core ethic of compassion for all animals. The Humane Society of the United States is one group that had to reconcile the dual mission of protecting domestic cats, birds and other wildlife, reexamine beliefs and find the common ground to enable the organization to move more nimbly toward the collective goal of reducing the number of cats living on the landscape. This talk will also discuss cats in the larger context and the factors that contribute to our current overpopulation of outdoor cats; the motivations and challenges of cat advocates and how they can be leveraged to help wildlife; and the role of animal shelters in aiding both companion animals and wildlife. By shifting our discussion to areas of agreement and expanding avenues for understanding and collaboration, we can achieve a significant decrease in the number of free-roaming cats, for the benefit of both cats and wildlife.

URBAN DEER POPULATION CONTROL: DIFFERENT OPTIONS FOR DIFFERENT LOCATIONS.

Ursula Bechert, University of Pennsylvania, bechertu@sas.upenn.edu; Tony DeNicola, White Buffalo, Inc.; Mark Fraker, SpayVac-for-Wildlife, Inc.

Overabundant populations of deer in urban and suburban areas can contribute to animal-vehicle collisions, disease transmission, adverse impacts on other wildlife, and damage to vegetation. In many communities, hunting is not possible, making fertility control an appealing option for controlling population size. Practical and logistical field application challenges are site-specific based on terrain and other variables. Some steroid hormone implants (e.g., diethylstilbestrol; DES) and porcine zona pellucida- (pZP) or gonadotropin releasing hormone- (GnRH) based immunocontraceptive vaccines have proven effective for 1-2 years; however, DES can be passed through the food chain and frequent application requirements limits the utility of these options in the field. Density-dependent changes in mortality and survivorship require that a large proportion (80% or more) of a closed population needs to be treated to affect a decline in numbers, and immunocontraception must have multi-year efficacy to be technically feasible and cost-effective. This presentation will review successful methods of deer fertility control, including surgical sterilization and immunocontraception using SpayVac®. Ovariectomy is preferred over tubal ligation because females will not continue cycling and results are 100% effective. However, costs range from \$500 to \$1,500 per deer based on labor. SpayVac has been tested in fallow (*Dama dama*) and white-tailed (*Odocoileus virginianus*) deer with 80 to 100% contraceptive efficacy for 5 years following a single injection. Costs of administration are comparatively less; however, females continue to cycle after vaccination. The pros and cons of using these two types of fertility control will be evaluated based on site characteristics and constraints.

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SURVIVAL AND COMPETING MORTALITY RISKS FOR MOUNTAIN LIONS IN THE GREATER LOS ANGELES AREA.

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Wildlife populations persisting in human-dominated landscapes often face high rates of mortality associated with human activities, but may also be subjected to natural mortality. For mountain lions, mortality risk may vary across age and sex classes, which has important implications for population dynamics. Accordingly, we estimated annual survival and cause-specific mortality rates for 57 mountain lions radio-tracked between 2002-2018 within the greater Los Angeles metropolitan area and investigated intrinsic (sex and age class) and extrinsic (study region) factors influencing mortality risk. Sex and study region did not influence mortality risk, but younger age classes (subadults and kittens) were more likely to die than adults. Annual survival was 0.84 (SE = 0.05) for adults, 0.69 (SE = 0.08) for subadults, and 0.65 (SE = 0.11) for kittens. For independent-aged mountain lions (adults and subadults), annual cause-specific mortality rates were 0.10 (95% CI [0.05, 0.15] for human causes, 0.06 for strife [0.02, 0.10], and 0.05 for unknown [0.01, 0.09]. Mortality risk from human-causes was greater for adults relative to subadults, whereas mortality risk from strife was higher for subadults. Adult survival has the greatest influence on population growth for mountain lions, which highlights the importance of mitigating human-caused mortality risk for this age class to conserve mountain lions in the region. We present one of the few quantitative estimates of mortality for mountain lion kittens obtained from radio-tracking kittens tagged at natal dens. Our results confirm earlier speculation as most kitten mortality occurred during the first 3 months of life.

THE COGNITION OF 'NUISANCE' ANIMALS.

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Recent work in animal cognition has focused on how animals respond to new or changing environments. Although many species are currently in decline, other species are thriving in human-altered habitats by taking advantage of new resources and opportunities associated with anthropogenic disturbance. Yet, as a result, these same species are often in conflict with humans and treated as a nuisance. Therefore, cognitive abilities such as innovation and behavioral flexibility may, paradoxically, lead to the demise of especially adaptive individuals. Here we review what is known about the cognition of 'nuisance' species and 'problem' individuals to shed light on the struggles of coexistence with humans along disturbed landscapes. We take an in-depth look at several cognitive abilities that are hypothesized to be of critical importance for species that are successfully utilizing human-altered environments, including neophilia, boldness, categorization, innovation, memory, learning, social learning and behavioral flexibility, and examine evidence that these cognitive abilities may also bring animals into conflict with humans. We also highlight some examples of species that may be using

cognitive mechanisms to change their behavior to avoid conflict with humans. We then discuss the role of animal cognition in current mitigation strategies that have been developed to address human-wildlife conflict. Additionally, we consider the role that human behaviour and perception of animals might play in either worsening or lessening conflict with wildlife. Finally, we propose some directions for future research and suggest that empirical investigation of 'nuisance' animal cognition could reveal the cognitive mechanisms underlying adaptation to anthropogenic change as well as help mitigate human-wildlife conflict.

CONNECTIVITY ASSESSMENT AND PLANNING IN DYNAMIC URBAN SYSTEMS: THE METRO HABITAT CONNECTIVITY TOOLKIT.

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Habitat fragmentation is a serious threat to maintaining biodiversity particularly in urbanizing areas. Methods exist to model habitat connectivity, however many of these are applied at large scales and rely on data that may be a decade or older, resulting in inaccuracies when compared to on the ground conditions, particularly in dynamic urban systems that experience rapid change. These issues make taking action to preserve or enhance these connectivity zones difficult, if not impossible. The Metro Regional Habitat Connectivity Toolkit approaches this problem by combining GIS analysis with on the ground assessments at realistic scales for land acquisition, restoration projects and/or barrier mitigation. We employed a surrogate species approach to address connectivity needs in a way that incorporates empirical data. Local information and research was combined with other habitat attributes to focus development of field assessments for habitat quality and barrier permeability. The field assessments allow technicians to verify GIS data, identify barriers and record habitat attributes in a way that is comparable across multiple habitat connectivity zones and for multiple species. Once assessments are concluded the resulting information is used to generate two species specific scores for habitat quality and barrier permeability. These scores identify where on the landscape restoration and/or land acquisitions would provide the most connectivity benefit vs areas where mitigation for barriers such as wildlife passages structures across roads are the priority. This toolkit is in the final stages of development and is currently being testing in pilot areas in the Portland Metro region.

CHOOSING APPROPRIATE METRICS TO ASSESS SUCCESS AND FAILURE OF WHITE-TAILED DEER MANAGEMENT – NOT JUST IN SUBURBIA.

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Management of large herbivores is contested – not just in suburban landscapes. For example, not acting on warnings about ecological and economic consequences of expanding white-tailed deer populations in the absence of large carnivores led to exploding populations. Now spirited debates about lethal management in suburban areas and utility of recreational

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hunting challenges wildlife management agencies to respond appropriately. Developing deer management approaches that are acceptable to a majority of citizens has been handicapped by the lack of locally available evidence of (a) white-tailed deer impacts, and (b) outcomes of various lethal or non-lethal management on ecological, economic or human health indicators. We evaluated an 'indicator method' using deer browse rates on planted red oak (*Quercus rubra*) seedlings, a method that can be easily implemented, including in heavily impacted suburban areas with little existing understory vegetation. Our results show that deer (and not rodents or introduced earthworms) are the major factor preventing red oak regeneration. Furthermore, our indicator was sensitive to changes in deer populations over a decadal timeframe with declining browse rates as deer populations declined using depredation permits and lethal approaches. This effect was not seen in areas where deer were sterilized or in areas open to recreational hunting. With such locally obtained data, managers and agencies can determine optimal strategies to achieve regeneration outcomes. Similar approaches of planting native indicator species can be implemented with ease and at low costs to assess mammalian herbivore browse pressure and the success or failure of different management strategies.

THE DC CAT COUNT.

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Management of outdoor cats is controversial, in part because the effectiveness of TNR programs is often not measured using objective methods. The DC Cat Count (DCCC) brings together partners from animal welfare and conservation science who believe that developing practical but rigorous methods for measuring the outcomes of cat management programs is a key to better collaboration and more efficient pursuit of shared goals. The three-year goal of the DCCC is to develop quantitative estimates of all cats living outdoors, indoors, or in animal shelters in the District of Columbia. This will be done using best available scientific approaches and protocols that include camera trapping, household surveys, transect-based cat counts, and shelter counts. These data will be analyzed to develop population size estimates, to understand the dynamics that characterize the overall cat population, and to determine how well simpler cat counting methods index underlying populations. The longer term goals of the project are to develop and disseminate practical, vetted protocols and tools for monitoring and evaluating the impacts of cat management efforts; offering a highly-visible example of productive collaboration among diverse stakeholder groups; and foster a network of organizations that will adopt the approaches developed as a result of the project. Ultimately, we hope to contribute to a paradigm shift characterized by more effective and inclusive cat management, and to encourage the animal welfare and conservation communities to offer one another the benefits of their respective expertise and resources.

SPATIAL ECOLOGY OF URBAN STRIPED SKUNKS (MEPHITIS MEPHITIS) IN THE NORTHERN GREAT PLAINS.

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Few studies have investigated the ecology of urban striped skunks (*Mephitis mephitis*) despite their ability to thrive in these landscapes. Information on spatial ecology of striped skunks is important for rabies mitigation efforts via oral rabies vaccine (ORV) baits. Our goal was to obtain baseline spatial ecology information on urban striped skunks in the Northern Great Plains region that is lacking in the literature. Using radio telemetry, we tracked 22 (4 M, 18 F) skunks during September 2016 to November 2016 and March 2017 to November 2017. We used kernel density estimation with smoothing by least squares cross validation to estimate home range; male skunks ($\bar{x} = 4.36 \text{ km}^2$, $\text{SE} \pm 0.79$) had larger home ranges than females ($\bar{x} = 1.79 \text{ km}^2$, $\text{SE} \pm 0.24$). Female skunk home ranges varied by season with the largest home ranges detected during summer 2017. However, we discerned no difference between rate of female skunk nightly movements (m/hr) across seasons. We also found no evidence that use-availability was associated with habitat type or season among female skunks. Female skunks were more likely to be found closer to water; however, we found no association of use with road characteristics within the study area. Targeting ORV efforts in areas near water may be warranted in our study area, but differences in available urban skunk habitat selection studies suggest that ORV baiting programs may not be one-size-fits-all, and a framework for effective bait placement would benefit from studies specific to management areas of interest.

URBAN WILDLIFE FROM PARKLANDS TO DOWNTOWN LOS ANGELES.

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Los Angeles is the second most populous city in the country, and though most of the land in the Los Angeles Basin has been developed, pockets of natural area remain in the city, and many levels of government and conservation groups are actively working to restore natural areas for use by the public and wildlife. As part of this effort to restore natural areas in Los Angeles, the City has set a goal of protect native biodiversity. However, to date there is very little information about that biodiversity, specifically what species occur where, or about what factors influence those patterns in and around urbanized areas of Los Angeles. Due to this lack of knowledge and the desire to restore natural areas the National Park Service (NPS) has started a project to collect information on the presence of wildlife species that can be detected with trail cameras in urban Los Angeles. Specifically we are monitoring wildlife presence with trail cameras along a 65 km transect centered on the Los Angeles River extending from downtown Los Angeles through the San Fernando Valley to Bell Canyon to the west. The cameras are maintained by partner organizations and volunteers who install and monitor the cameras each season. So far the project has completed four field seasons and has confirmed the occurrence of coyotes, bobcats,

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raccoons, opossums, skunks, mule deer, cottontail rabbits, eastern fox squirrels and California ground squirrels at monitored sites.

IT'S COMPLICATED: UNDERSTANDING THE LIVES OF SEA OTTERS IN MONTEREY BAY.

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Understanding spatial patterns of disease transmission at the land-sea interface is complicated by the unpredictable movements of hosts, agents and elements of the environment. The sea otter (*Enhydra lutris*) has been called a sentinel species and has proved a productive study species for understanding pathogen pollution in its nearshore habitat. We summarize research on sea otters as sentinels of nearshore ecosystem health and in particular, work characterizing risk factors for *Toxoplasma gondii* infection in sea otters, including behavioral, dietary and environmental factors. Strong evidence has been found for a link between *T. gondii* infection risk and freshwater inputs and areas of increased human population density, although patterns are mediated by complexities of animal behavior, dietary specialization, watershed hydrology and nearshore habitat. We discuss results of a mixed mechanistic-probabilistic model of the transmission of *Toxoplasma gondii* encompassing multiple steps between definitive host (felid) shedding and sea otter infection, including oocyst loading/mobilization, transport and individual infection risk. The results suggest that *T. gondii* infection prevalence in sea otters is sensitive to changes in oocyst loading and marine habitat (hard vs. soft substrate, kelp beds) and is affected by host heterogeneity (including individual prey preferences). Variables describing the terrestrial watershed were not informative after accounting for their effects on oocyst loading. Findings are examined in light of earlier work describing sometimes counter-intuitive results when comparing sea otters at urban and less disturbed sites. Understanding the lives of sea otters turns out to be more complex than previously thought.

USE OF BAIT STATIONS BY NON-TARGET WILDLIFE AS A ROUTE OF EXPOSURE OF CARNIVORES TO RODENTICIDES.

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Anticoagulant rodenticides (ARs) are used in urban settings to control commensal rodent populations. Native rodents can be exposed to ARs directly, through direct consumption of AR baits, whereas scavengers and carnivores, such as coyotes (*Canis latrans*), can be exposed indirectly by eating AR-laden prey. The extent to which native species visit AR bait stations, however, is unclear. We used Reconyx trail cameras to monitor use of commercial bait stations in 90 residential yards in Orange County, California. Two stations, baited but with no ARs, were monitored continuously in each yard for approximately 30 consecutive days during the dry

and wet seasons. One bait station was placed on the ground, whereas the other was elevated 1.5–2 m. Based on dry-season results, most yards (80%) had roof rats (*Rattus rattus*), which discovered ground and elevated stations quickly (median = 4 and 6 days, respectively) and entered them at similar rates. Most yards (84%) also were visited by at least one species of wild mammal (range = 0–6), with much more activity at ground cameras. Wild mesocarnivores were recorded at ground cameras in 52% of yards, with opossums (*Didelphis virginiana*) the most common (38%). Native rodents, including ground squirrels, deermice and woodrats, were only detected in 13% of yards. Cats, which may consume AR-exposed prey and then be eaten by coyotes, were recorded in 54% of yards. Presently we are completing our wet-season sampling, and exploring statistical models to determine whether yard- or landscape-scale characteristics best explain visitation of bait stations by wildlife.

POPULATION GENOMICS OF URBAN MAMMALIAN POPULATIONS IN THE MEGACITY OF LOS ANGELES BASED ON ddRADseq DATA.

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Urban areas contain an estimated 55% of the world's population today, compared to just 15% in 1900, and the gradual shift from rural to urban residence is expected to continue. Along with the increase in urban-dwelling is the appearance of 33 megacities (populations of 10+ million people), with another six cities expected to reach "mega" status by 2030. In light of these trends, greater understanding of the impact of the megacity landscape on co-residing populations of non-human mammals is much needed. In this work, we take a partial representation (ddRAD) genome sequencing approach to study population and landscape genomics of urban mammals (coyote, striped skunk, raccoon, fox squirrel, and opossum) in the megacity of Los Angeles. Tissues for DNA extraction were sourced from a biological material bank generated from road-kill and collaborative means in the broader "LA Urban Mammal Project". A single ddRADseq pipeline suitable for application in all sampled species was developed. Population and landscape genomics based on ddRADseq data will be employed to address questions regarding the natural populations of these species in LA including, for example, estimating the genetic diversity and size of their populations, assessing evidence for significant change in population size in the recent past, and evaluating if features of the landscape could be related to enhanced or reduced gene flow between populations across LA. Together the various components of this project will enhance our understanding of the social-biological interaction between human and non-human mammalian populations coexisting in urban areas and megacities in the Anthropocene.

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SCIENCE TAKES FLIGHT: EVOLUTIONARY ECOLOGY OF FERAL PIGEONS AND COMMUNITY ENGAGEMENT.

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Feral pigeons (*Columba livia*), also known as rock doves or rock pigeons, are common urban birds that are often either revered or reviled by city-dwellers. Despite living alongside humans for over 5,000 years, and thriving in urban environments, very little research has been done on feral pigeon populations. Here, I explore how urbanization has shaped the ecology and evolution of pigeons in the Northeast Megalopolis (Boston, MA to Washington, DC) and the evolutionary consequences of being a human commensal. Additionally, I discuss my work with local community members. Specifically, I discuss inviting the public to watch and help me collect data, ultimately leading to a conversation about urban wildlife, ecology, and evolution. With these conversations I hope to help shape the narrative around urban wildlife and help communities see value in scientific research.

CITY SNAKES: THE (LIMITED) SPATIAL ECOLOGY & GENETICS OF COPPERHEADS IN AN URBAN FOREST.

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Fragmentation associated with anthropogenic environments leads to changes in movement patterns and spatial use in a wide variety of taxa. Limited mobility organisms, such as snakes, may be constrained to native habitats within cities. This study examines the spatial ecology of the southern copperhead (*A. c. contortrix*) within Overton Park, a heavily used area bordered by roads in Memphis, Tennessee. Copperheads were tracked periodically to collect spatial and habitat information. Geographic data were analyzed using different spatial models to determine home range estimates and movement parameters. Home ranges and core areas in the Overton population are smaller than previously reported for this species and compared to a rural site. Consequently, average daily movement is also less than rural copperheads. Contrary to previous studies, no differences in spatial patterns between the sexes were noted. Urban copperheads may adapt to fragmentation by decreasing overall movement and home range size.

MESOPREDATOR OCCURRENCE AND DISTRIBUTION IN AN URBAN ENVIRONMENT IN THE SOUTHERN HIGH PLAINS OF TEXAS.

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Urban landscapes provide valuable habitat to several mesocarnivores, however, few studies have been performed to determine what environmental features influence mesocarnivores presence and occupancy within urban areas. We used game cameras dispersed throughout portions

of the city of Lubbock, Texas to characterize presence of coyote (*Canis latrans*), domestic cat (*Felis silvestris catus*), domestic dog (*Canis lupus familiaris*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoon (*Procyon lotor*), and Virginia opossum (*Didelphis virginiana*). Presence was correlated with environmental factors including grasslands, croplands, and human disturbance using a geospatially explicit supervised classification within ArcGIS. These features were measured in areas around cameras deployed throughout the Lubbock city limits. For those species with sufficient detections, preliminary analyses suggest that cat occupancy decreases with increases in open grasslands; gray fox occupancy increases with decreases in open vegetation; and coyote occupancy is positively related to increases in open grasslands. Virginia opossum occupancy increases in areas of human development and dogs currently show no correlation with any of these factors analyzed, despite a naïve occupancy of 39%. Previous analyses focused on grouping cameras into clusters, however current analyses are building upon that work, and including individual camera approaches to refined correlation interpretation at smaller scales. Further analysis will include other local scale habitat features, and socioeconomic factors to ideally improve model performance.

EXPERIENCES FROM A 20-YEAR DEER MANAGEMENT PROGRAM IN CLEVELAND METROPARKS.

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Cleveland Metroparks (CM) is comprised of 18 reservations spanning more than 23,000 acres across 5 counties in northeastern Ohio. CM staff have been monitoring and studying deer on these lands since the early 1980s, and field surveys demonstrated a rapid decline in forest plant communities associated with increased deer densities. After exploring options for reducing deer populations, culling began in 1998 in areas identified from deer-density and browse-impact data. Demographic data has been collected since the program's inception and health monitoring began in 2006, including various zoonotic disease studies. CM continues to conduct monitoring and research projects to investigate success and evaluate alternatives to the current management program. CM tested immunocontraceptives in the early 2000s and is currently evaluating deer removal via archery. A fawn survival study identified that over 75% of fawns survived annually, while coyote predation was only 5%. CM has used a number of annual field surveys to monitor deer populations. However, for a metropolitan park system, monitoring the environment's response to the deer population and reducing associated vegetation impacts, is more important than managing deer to a given number. CM is currently exploring the use of large-scale camera arrays to develop an index of deer pressure. Lethal wildlife management is controversial, and sharing information from monitoring and research projects is important so that the public understands why deer are managed. Working with neighboring municipalities and park districts to convey accurate information about management efforts is a critical component to a successful deer management program.

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GENETIC DIVERSITY AND CONNECTIVITY OF THE NORTHERN RED-LEGGED FROG IN AN URBANIZED LANDSCAPE.

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Population persistence ultimately depends on the health of local populations and their connectivity to other sites. Small, isolated populations have higher chances of local extinction whereas larger, well-connected populations are less vulnerable to perturbations. With urbanization, species are occupying increasingly heterogeneous landscapes with patches of varying suitability that may reduce and isolate populations. Identifying landscape features which support populations and facilitate connectivity provides important information for conservation and land management. We investigate how landscape in the greater Portland Metropolitan Region impacts genetic population connectivity in the Northern Red-legged Frog (*Rana aurora*), a surrogate species in Oregon serving as a management indicator for riparian habitat. The Northern Red-legged Frog requires well-connected terrestrial and aquatic habitat for migration to and from breeding sites, but the degree to which specific landscape characteristics influence population persistence and movement is unclear. We predict that intact upland habitat and riparian corridors are necessary to maintain large, well-connected populations of Northern Red-legged Frogs. In contrast, we expect that lower forest cover and a greater amount of impervious surface cover results in the isolation and decline of local populations. We present the results of landscape genetic analyses of microsatellite data for over 300 individuals of the Northern Red-legged Frog from over 18 breeding sites in the Portland Metropolitan Region. We discuss how landscape features vary with within-site measures of population genetic diversity as well as among-site estimates of population connectivity.

TRAFFIC NOISE AND LIGHT REDUCE THE EFFICACY OF WILDLIFE CROSSING STRUCTURES.

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Wildlife crossing structures (WCS) over or under highways can reduce the risk of wildlife-vehicle collisions and reconnect fragmented habitat by facilitating safe wildlife passage. However, traffic-related light and noise disturbance may impact the efficacy of WCS through altering species' occupancy and behavior at WCS. During May 2016 – 2019, we used camera traps to record species presence (Bushnell Aggressor; still image mode) and vigilance behavior (Browning's Dark Ops Pro; video mode) at 26 WCS located across interstate and state highways within California for a 30-day period. Noise levels (dBA and dBC) and light intensity were recorded between 8pm – 12am at each structure. In order to capture baseline noise levels and species presence within the surrounding area, camera traps and sound meters were

simultaneously positioned ~1km from the WCS. Camera trap data were processed and analyzed using Wildlife Observer Network and Behavioral Observation Research Interactive Software. We used a combination of logistic regression and generalized linear mixed-effects models to examine the influence of traffic noise and light, traffic volume, human presence, surrounding vegetation and WCS dimensions on species presence and vigilance. We found that species presence was greatest at intermediate noise levels, with species-specific differences in thresholds of tolerance to noise, and vigilance increased at noisier WCS. Preliminary results suggest light intensity may negatively impact species presence at WCS. Results can inform agencies of tolerance thresholds to traffic light and noise levels and suggest WCS that would benefit from mitigation measures such as noise and light screenings.

FOSTERING RELATIONSHIPS TO STUDY RELEVANT QUESTIONS IN UNDERSERVED URBAN AREAS: COYOTES AND HUSTON TILLOTSON UNIVERSITY.

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Texas Parks and Wildlife Department (TPWD) has strong relationships with well-established traditional wildlife programs. These relationships have produced scientific knowledge relevant to our traditional wildlife management priorities. As a private property state, Texas recognizes the vital importance of using the knowledge gained through these investigations to assist landowners in managing their land for the benefit of wildlife. We also recognize that only 1% of Texans own land that qualifies as “agricultural land.” We must address the concerns of the 85% of Texans who live in urban areas and the 99% who do not own land under agricultural valuation. Huston-Tillotson University (HTU) is a private, historically black University in Austin, Texas. HTU recently began the Environmental Studies course of study, guiding students through coursework in ecology, environmental law, conservation biology, descriptive writing, environmental history, environmental literature, environmental sociology, chemistry, climate science and economics. TPWD is currently fostering a relationship with HTU in a pilot project that investigates subjects of interest to urban residents (“Investigating Urban Coyotes as Environmental Sentinels.”) We anticipate this partnership will provide benefits to TPWD, HTU, and urban wildlife and habitat managers throughout Texas, including: 1. Increased awareness of environmental issues relevant to urban residents, and increased funding of activities addressing those priorities, 2. Increasing the diversity of the pool of emerging wildlife professionals, 3. Providing HTU students with relevant, marketable skills and relationships that will strengthen their career potential.

SHEDDING LIGHT ON THE GROWING ISSUE OF ECOLOGICAL LIGHT POLLUTION.

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For 4.5 billion years, night on Earth was lit by the moon and stars, and life evolved under regular cycles of bright days and dark nights. Today, satellite photos of our planet illustrate nights liberally colonized by artificial light. The overabundance of light at night has dire ecological consequences for birds, fish, amphibians, mammals and plants, as well as for human health and culture. A growing body of research is focused on the study of ecological light pollution: the

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impact of artificial light on natural ecosystems, which is associated with fragmenting of habitat for nocturnal species; changes in circadian rhythms that impact reproductive, social, foraging and migratory behavior; alterations in predator-prey relationships; and a range of physiological impacts that can have implications for everything from fledgling success to disease resistance. Artificial light at night has most famously been associated with impacts on migrating birds and nesting sea turtles, but the consequences on complex and carefully choreographed ecological systems are even more ubiquitous. Our urban areas are growing like never before, and as climate change and sustainability drive energy-efficiency demands, we need to ensure that we are on a trajectory to protect the ecological function of our cities, by thoughtfully mitigating the effects of ecological light pollution through well-designed lighting and by raising public awareness and investment in the value of dark skies and healthy ecosystems. Portland Audubon's Bird Safe Program is working to educate the public as well as architects, landscape architects, designers, planners, and elected officials about the hazards of and solutions to light pollution in order to ensure that we are designing our built landscape for ecological resilience into the future. We look forward to sharing our strategies, struggles and successes in this work.

***LONG-TERM PATTERNS OF URBAN TOLERANCE IN NESTING RAPTORS IN THE MALIBU CREEK WATERSHED OF SOUTHERN CALIFORNIA.**

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Globally, many raptor species are treated as special-status species, while others are considered urban-tolerant at some scale, yet these assessments have changed through time. By identifying the least-tolerant species to urbanization, we can update priorities for conservation, and can direct greater conservation attention to those birds in greater need of protection and accommodation. We analyzed nest placement of 179 nests for six raptor species in the Malibu Creek Watershed of Los Angeles and Ventura counties (California) since 1971, generated an index of urban landuse surrounding each nest, and compared this with 100 randomly-generated points to identify changes in urban tolerance over time. Reconstructing a historical urban boundary, we estimate a three-fold increase of urbanized habitat and a doubling of the human population within the study area in the past fifty years. Two of the six species have since become extirpated as breeders here (Golden Eagle *Aquila chrysaetos* and White-tailed Kite *Elanus leucurus*). We document a strong recent shift toward urban sites for Cooper's Hawk *Accipiter cooperii*, yet found no such bias over random sites for either Red-shouldered Hawk *Buteo lineatus* or Red-tailed Hawk *B. jamaicensis*. We identify American Kestrel *Falco sparverius* as an "urban avoider", found in significantly less urbanized areas than random points, with a strong preference for native (vs. non-native) nest tree species, a pattern reversed in the other remaining species. Our findings emphasize the importance of updating species conservation assessments as landscapes urbanize, as species either adapt to these changes or fail to do so.

WHAT'S THAT BUG? CONNECTING KNOWLEDGE TO STATED CONSERVATION BEHAVIORS OF URBAN STUDENTS.

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Arthropods are declining across the globe, yet provide critical ecosystem services. Knowledge gain of arthropod roles could increase support for their conservation. Evidence suggests knowledge and attitudes are more highly correlated in children and environmental attitudes are shaped before age 12. Differences in the connection between knowledge, attitude, and behaviors towards arthropods may also be different in children from urban versus rural locations due to varying experiences with arthropods. After either a basic biology lesson or a conservation lesson in both urban and suburban 4th and 5th grade classes, it was found that urban students had significant lower knowledge, attitudes, and stated behaviors towards arthropods but also exhibited the greatest positive changes when presented the conservation-based lesson. Being able to name the arthropod correctly was related to more positive attitudes and stated behaviors and stated conservation behaviors increased with knowledge of the arthropod's role in the ecosystem. Education in urban schools with a focus on distinguishing arthropods as well as ecosystem services and conservation need provide the most change per effort for conservation. Insect or arthropod lessons could be done by local professors, graduate students, or undergraduate students in urban classrooms or green spaces. Using the rare Mojave poppy bee and its pollination mutualism as a case study for potential classroom use, I will connect this work to broader and current insect conservation actions in urban areas of the Mojave Desert.

URBAN HABITAT USE RELATES TO ANTHROPOGENIC DIET AND PHYSIOLOGY FOR THE WHITE IBIS (EUDOCIMUS ALBUS) IN SOUTH FLORIDA.

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Wildlife that successfully exploit urban habitats and anthropogenic resources may exhibit altered movement and physiology related to urban adaptation. Traditionally-nomadic White Ibis (*Eudocimus albus*) are recently abundant in urban Florida and may experience such shifts compared to their wetland counterparts. We explored the influence of anthropogenic diet, natural history (sex, age, season), and physiology (stress, immunity, condition) on habitat use by sampling ibis in Florida (2015–2017) along a gradient of 0% to 90% surrounding urban land cover. Here, we focus on 15 ibis for which we obtained both reliable movement data (EcoTone GPS locations) and a suite of dietary and physiological parameters (whole-blood isotopic ratios, corticosterone stress response, innate immunity via bactericidal capacity). We classified each

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ibis based on nonbreeding season GPS locations into “urban” (>50% urban use) or “non-urban” (<50% urban use) and determined if urban habitat use was best predicted by diet, physiology, or natural history. We additionally explored physiological differences between “urban” and “non-urban” ibis. Ibis captured at sites with greater surrounding urban land cover were later detected more often in urban areas ($F_{1,13}=15.36$, $R^2=0.54$, $p<0.01$). Diet best predicted habitat use, followed by natural history (generalized linear models with AICc). “Urban” ibis consumed more anthropogenic foods ($t_{12.52}=-4.89$, $p<0.001$), and had higher bactericidal capacity ($t_{11.83}=-2.09$, $p=0.05$) and lower stress response (nonsignificant trend). Our results suggest food resources primarily drive ibis urban habitat use, but physiological differences including higher innate immunity and reduced stress response may help ibis better adapt to altered urban areas without adverse health impacts.

LESSONS LEARNED FROM A DECADE OF URBAN DEER MANAGEMENT IN A UNIVERSITY SETTING.

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Because of increasing negative deer impacts, in 2007 we implemented a deer study on Cornell University lands in Tompkins County, New York. We strived to reduce deer numbers and associated impacts via surgical sterilization on core campus, and an Earn-a-Buck (EAB) hunting program on surrounding university lands. These approaches were complemented with assessments of deer abundance and ecological outcomes. During 2008 to 2013, we sterilized >90% of female deer on core campus, and Cornell EAB hunters harvested 606 deer on lands outside the campus sterilization zone. It became clear that we could not reduce deer numbers to levels that alleviated negative impacts. By winter of 2013, we stabilized the core campus deer herd at approximately 100 animals (38.6 deer/km²), a density much higher than project goals. We did see a decrease in does and fawns appearing on campus, however, this was offset by an increase in buck numbers. Consequently, during March 2013, we started using Deer Damage Permits (DDPs), allowing volunteers to cull deer over bait and at night using archery equipment. Our efforts demonstrated that these methods could be safely and effectively conducted in densely populated areas with high public use. In concert with continued deer hunting, the expanded use of DDPs resulted in a herd reduction of approximately 45% in just one year on core campus. Some other form of lethal deer management (e.g., culling, sharp-shooting, or capture and euthanasia) will be needed to supplement hunting and reduce deer numbers in an acceptable time frame (<5 years).

***HUMAN-ELEPHANT INTERACTION IN NORTH-WEST INDIA - DRIVERS, PATTERNS AND CONSERVATION IMPLICATIONS OF CROP-RAIDING BEHAVIOUR IN A HUMAN DOMINATED LANDSCAPE.**

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India; Qamar Qureshi, Wildlife Institute of India; A.C. Williams, World Wildlife Fund – Myanmar; S.P. Goyal, Wildlife Institute of India.

The largest fraction of the global Asian elephant (*Elephas maximus*) population inhabits India often utilizing suboptimal habitat patches. Forced co-existence at the forest-human settlement interfaces in semi-urban and urban north-west India results in frequent negative interactions. Therefore, conservation strategies must attempt to alleviate human-elephant conflict by elucidating the patterns and biological drivers of elephants straying from forests and raiding crops. To address this issue, we estimated habitat use by the elephant in Rajaji Tiger Reserve (RTR), India employing occupancy framework with suitable co-variables ($n=12$) while recording spatiotemporal patterns of crop-raiding through semi-structured questionnaire surveys ($n=90$) along RTR periphery. We used multi-locus microsatellite genotyping ($n=5$) for molecular tracking of elephants using non-invasive fecal DNA ($n=117$) from raided crop-fields across 45 months. Elephants naturally frequented the RTR fringes interspersed with crop-fields and settlements, being driven by forage availability, forest cover, terrain and weed abundance ($\Delta AIC < 2$). Raids were frequent in the winters (65.5%) and during 2100-0000 hours (64.4%). We identified 69 unique genotypes ($PID=3.6 \times 10^{-4}$) from the fecal DNA. We found that 15 elephant individuals carried out 54.7% of the total raids, while six animals had ≥ 5 genetic recaptures. Mean time between recaptures of individuals was 80 days whereas the mean minimum convex polygon perimeter of the recaptures was 76.6 sqkm which indicated that habitual crop raiding individuals operated in specific areas. Though the insight gained from the multidisciplinary study is useful for adaptive management of human-elephant conflict, long-term data on spatial and nutritional ecology of elephants and landscape-specific socio-economy would provide lasting solutions.

SEATTLE'S ADAPTABLE URBAN COOPER'S HAWKS.

Ed Deal, Seattle Cooper's Hawk Project – Urban Raptor Conservancy, falcophile@comcast.net.

Twenty-five years ago Cooper's Hawks began colonizing urban and suburban landscapes throughout the US, developing a tolerance for living in proximity to humans. The Seattle Cooper's Hawk Project is one of several studies in large US cities (e.g., Tucson, Milwaukee, Albuquerque) and the only all-volunteer, citizen science project. Since 2012 the group has monitored local Cooper's Hawk population nesting density and annual nest productivity. A color-ID banding program helps us track fledgling dispersal, longevity, and fidelity of adult breeding and wintering sites. Study results show annual increases in nesting pairs, high nest success rates, high fledgling productivity, little evidence of migration, strong site fidelity and mostly short natal dispersal distances. In 2012 we documented 26 nesting attempts, with 22 successful nests producing 70 fledglings. By 2018 these numbers had doubled: volunteers monitored 46 nesting attempts; 40 nests succeeded; producing a record annual high of 145 fledglings for our seven-year study. Nest productivity is consistently high, averaging 3.6 fledglings per successful nest in 2018, with three nests fledging 5 young. We continue to find a high-percentage of breeding females still in juvenile plumage (24%), indicative of an expanding population. Seattle's Cooper's Hawks show a preference for nesting in city parks and greenbelts planned by the Olmsted firm. Preliminary data on nest-building and incubating pairs for the 2019 season will also be presented.

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WHITE-NOSE SYNDROME IMPACTS TO BAT COMMUNITIES ALONG A RURAL-URBAN GRADIENT.

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White-nose Syndrome (WNS) has reduced the abundance of many bat species on the East coast, including the National Capital Region (NCR). Our study objectives were to document presence and habitat association of bats within the NCR and compare findings to pre-WNS surveys conducted in 2003 and 2004. In 2017, we acoustically resurveyed pre-WNS sites using the same active sampling methods. We also surveyed the area using passive acoustic methods and mist netting from 2016 to 2018. We used non-metric multidimensional scaling and occupancy modeling to determine how habitat associations have changed throughout the region. Our results indicate presence of federally listed northern long-eared (*Myotis septentrionalis*) and Indiana bats (*Myotis sodalis*) and other bats of conservation concern such as the tri-color (*Perimyotis subflavus*), small-footed (*Myotis leibii*) and little brown (*Myotis lucifugus*) bats. In our comparison of pre- and post-WNS communities, we documented a shift in the community structure as big brown bats' (*Eptesicus fuscus*) relative presence increased on the landscape. For all periods, fine- and landscape-scale urbanization levels impacted the distribution and abundance of bat communities, with the exception of Rock Creek Park in the District of Columbia, which maintains high biodiversity despite its urban location.

URBAN WILDLIFE CONSERVATION IN PRACTICE.

Megan Dillon, Indiana Department of Natural Resources, USA, mdillon@dnr.in.gov.

Over the past three years, the Indiana Department of Natural Resources has been operating an innovative "Urban Program" within the Division of Fish and Wildlife. The Urban Program works to create high-quality habitat in urban spaces that benefit both people and wildlife. This habitat initiative is paired with a public education effort, focusing on fostering wildlife appreciation in cities and mitigating nuisance wildlife concerns. Two full-time Urban Wildlife Biologist provide technical assistance and administer financial assistance with cost-share agreements. Many other urban conservation organizations exist in Indiana, particularly in Indianapolis. 'Urban Green Spaces' have become a familiar concept, established to perform ecosystem services such as stormwater management and soil health improvements. Valuable though these spaces may be, they can often be greatly improved by small changes to benefit wildlife, such as plant species selections or maintenance practices. The Urban Program has found its niche by partnering with a variety of these organizations, making simple suggestions for existing plans that significantly strengthen their value to wildlife. The main purpose of this presentation is to provide a framework for state urban wildlife conservation programs and report on the success of

the new Urban Program in Indiana.

EVALUATING HUMAN-COYOTE ENCOUNTERS IN AN URBAN LANDSCAPE USING iNATURALIST.

David Drake, University of Wisconsin-Madison, ddrake2@wisc.edu; Shelli Dubay, University of Wisconsin-Stevens Point; Marcus Mueller, Skedaddle Wildlife Control; Maximillian Allen, Illinois Natural History Survey, University of Illinois.

Coyotes have inhabited urban areas throughout North America for decades. Reports of human-coyote interactions typically are anecdotal or through the media, and usually only when negative consequences of the encounter (e.g. attacks on pets or humans) have occurred. First-hand accounts are rare and tend to be biased toward a negative human-coyote interaction. We established an iNaturalist page where the public could report encounters with coyotes in Madison, Wisconsin in order to better understand human-coyote interactions. In addition to recording the date, time, and location of a coyote encounter, each observer answered 8 questions. Questions included if the observer had a dog with them at time of coyote encounter, estimated distance between observer and coyote, and estimated level of coyote aggression. We describe 470 direct human-coyote encounters between 2015-2018 reported to our iNaturalist page. Human-coyote encounters occurred primarily during crepuscular hours and in all months of the year. No domestic dog was present with the observer in 77% of the encounters. Average estimated distance between observer and coyote was 25 yards. On a scale from 0-5 (0 being the least aggressive), 96% of observers estimated level of aggression from the coyote they encountered to be 0 or 1. About 98% of the accounts reported that the coyote moved away from the human when the coyote either saw the human or the human attempted to haze the coyote. Our results can help inform urban coyote management and public education to promote positive co-existence between humans and coyotes sharing an urban landscape.

BACKYARD VEGETATION AND ARTHROPOD ABUNDANCE.

Marion Dresner, Portland State University, Portland, OR, USA, dresnem@pdx.edu.

We have been studying backyard food webs for the past 5 years. Living in yards, arthropods are part of the local urban food web. Both predacious arthropods like spiders and birds eat plant-eating arthropods. We expected native plants to be more ecologically productive and thus have more arthropods overall than non-native plants. The leaves of ornamental plants are usually not palatable to insects; plants produce defensive chemicals to avoid being eaten. Native arthropods are adapted to the chemicals that local native plants produce. We wanted to know if native plants actually “out-perform” non-native plants ecologically in terms of arthropod abundance in gardens and yards. This was not what we found. We also compared a number of common shrubs in different yards and found that snowberry, Rhododendron, Indian plum, English laurel, and red flowering currant had a greater abundance of arthropods than other shrubs. A yard’s proximity to a greenspace influenced arthropod abundance. Lastly, tree cover had an influence on arthropod and bird abundance.

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BARN OWL MAINTENANCE PROGRAM (BOMP).

Doris Duncan, Sonoma County Wildlife Rescue, Petaluma, CA, USA, scwrdoris@scwildliferescue.org.

The Barn Owl Maintenance Program (BOMP) is a program of Sonoma County Wildlife Rescue. Our goal is to help vineyard and homeowners with gopher problems by offering a natural, organic, integrated pest management solution. We consult with the landowners to find the best places to put barn owl boxes to entice barn owls to the property and install the boxes. Once the boxes are up, we do research in the spring to determine where the nesting pairs are located. That way, when the wildlife rescue receives orphaned barn owls, we can place them with foster parents in barn owl boxes. In fall, we clean and maintain the barn owl boxes to encourage continual use of the boxes. In this way, we believe we can help alleviate gopher problems through ongoing barn owl presence in our clients' homes and vineyards.

CONDUCTING URBAN ECOLOGY RESEARCH ON PRIVATE PROPERTY.

Karen Dyson, Department of Urban Design and Planning, University of Washington, karenldyson@gmail.com; Tracy Fuentes, Department of Urban Design and Planning, University of Washington.

Private property makes up a large proportion of urban green space and differs from public green space in ecologically important ways. While including private property in urban landscape research is necessary, ecologists are frequently unprepared to work on private property and thus often exclude private land from empirical studies. Of particular concern are the challenges of working with property owners and encountering members of the public during fieldwork. However, these interactions provide a unique opportunity for engaging with the communities that urban ecologists work in. This talk will address both these challenges and opportunities as well as the role of personal identity from the perspective of an early career scientist, using examples gleaned from 25+ interviews with urban ecologists at all career stages.

USING RESEARCH AS THE DRIVER FOR MANAGEMENT OF URBAN WHITE-TAILED DEER AT FORT DRUM, NY.

Martin J. Feehan, Department of Natural Resources, Cornell University, Ithaca, NY, mjf322@cornell.edu; Paul D. Curtis, Department of Natural Resources, Cornell University, Ithaca, NY.

Lack of public acceptance regarding some urban white-tailed deer management techniques, including lethal control, has stymied management efforts in many communities throughout North America. Since 2015, we have been conducting a study of urban deer at Fort Drum, New York, to investigate fawn survival in hunted areas to potentially mitigate high prevalence of Lyme disease, and for conservation of endangered bat habitat. To date, we have captured 396 deer and created a tissue bank of >650 samples to estimate population size, distribution, dispersal, vertical parasite transmission, population genetics, and response to removal. As the project grew in scope, so did our engagement with the community. Engagement was first focused solely on finding volunteers for fawn searches. We have now established multiple citizen-science channels for community members to assist with data collection via sightings,

tracking, and captures. Due to deer dispersals beyond 150km (and into Canada), this has become a multi-community effort. Initial results from areas with deer exclosures, coupled with high fawn survival, fecundity, and densities, suggested a clear negative impact from deer on endangered bat conservation areas due to lack of forest regeneration. In response, we helped initiate more aggressive management tactics in 2018, including active removal and earn-a-buck requirements for hunters. These efforts were controversial for some community members, but a majority accepted program efforts due to prior community engagement, and presenting the project as a research effort to prevent deer overabundance and associated negative impacts.

A CITY'S SIZE AND PROPORTION OF GREEN SPACE AFFECTS MAMMALIAN RELATIVE OCCUPANCY RATES AND RESPONSE TO URBANIZATION: AN ANALYSIS OF NINE CITIES ACROSS THE UNITED STATES.

Mason Fidino, Lincoln Park Zoo, mfidino@lpzoo.org; Liza Lehrer, Lincoln Park Zoo; Travis Gallo, Lincoln Park Zoo; Matthew Mulligan, Lincoln Park Zoo; Cria Kay, Lincoln Park Zoo; Adam Ahlers, Kansas State University; Julia Angstmann, Butler University; Carmen Salisbury, Butler University; Travis Ryan, Butler University; Laurel Hartley, University of Colorado Denver; Christopher Schell, University of Washington Tacoma; Ashley Gramza, Arkansas Game & Fish Commission; Amy Beldire, The Nature Conservancy; Kelly Simon Texas Parks and Wildlife Department; Max Amaya, California State University Long Beach; Ted Stankowich, California State University Long Beach; David Drake, University of Madison Wisconsin; Seth Magle, Lincoln Park Zoo.

Urban wildlife research has the capacity to guide future interactions and co-existence between humans and wildlife in urbanizing regions. Yet, most urban wildlife research is short-term and conducted within a single city. As cities vary in size, geography, age, culture, growth patterns, and land use, there is uncertainty whether results from one city generalize to others. To overcome these limitations, we designed the Urban Wildlife Information Network (UWIN), where partners collaborate across cities to collect long-term, systematic, multi-species data. UWIN's research design is centered on the establishment of research sites along spatial gradients of urbanization. Sites are selected along each city's urbanization gradient and encompass a swath of potential wildlife habitat. To date, a central focus has been on monitoring medium and large mammals with motion-triggered cameras. Here, we present results from UWIN's first multi-city analysis of urban mesocarnivores from nine cities across the United States. As housing density and impervious cover around habitat patches increased in each city, species richness decreased. However, the strength of this relationship was highly dependent on the size of a city. Large cities such as Chicago, Illinois or Long Beach, California exhibited the most negative correlations between a habitat patches species richness and level of urbanization. At the species level, relative occupancy rates of urban mesocarnivores and their response to urbanization varied between cities in a predictable fashion. For example, most mesocarnivores had lower average occupancy rates and more negative responses to urbanization as the proportion of green space within a city decreased.

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CITIES NEED URBAN WILDLIFE PLANS.

Patrick Fitzgerald, National Wildlife Federation, fitzgeraldp@nwf.org; Erik Ndayishimiye, National Wildlife Federation.

Urban wildlife are facing unprecedented challenges as development in the United States continues unabated. Habitat destruction and fragmentation means less habitat in urban and suburban areas and fewer corridors for species to move around. Climate change exacerbates the situation through the urban heat island effect, extreme weather events, more aggressive invasive plant species and increased polluted runoff, leading to increased stress on wildlife. While the federal government has the U.S. Fish and Wildlife Agency (and other natural resource focused agencies) and state have State Wildlife Action Plans, there is no equivalent at the local level. Most sustainability plans focus primarily on energy or water conservation efforts. Local planning departments typically oversee tree canopy. Parks and Recreation departments play an important role in conservation, but face competing priorities (i.e. - sports leagues). Most cities do not plan for or allocate their budgets to help wildlife. But what if they did? According to the Urban Institute, local governments spent \$1.5 trillion in 2015. If just one additional penny of every local dollar was spent on wildlife conservation, urban forestry, green infrastructure, and open space (that's \$15 billion annually), we could make real, meaningful change for wildlife. In this session, NWF will share examples of municipalities that are integrating wildlife conservation into sustainability, comprehensive or climate action planning and the budget process. NWF will present a blueprint for action to increase municipal planning for and spending on wildlife. Participants will have an opportunity to respond and make recommendations as well.

THE INFLUENCE OF HUMAN LAND USE ON THE ECOLOGY OF BAYLISASCARIS PROCYONIS IN ONTARIO, CANADA.

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Anthropogenic land use and its associated impacts on resource availability can affect the distribution and behaviour of wildlife, as well as pathogen transmission within and between species. Raccoons (*Procyon lotor*) are a successful urban exploiter species that carry many pathogens of concern for humans and domestic animals. One example is *Baylisascaris procyonis*, the raccoon roundworm, a zoonotic parasite whose larval stage causes neurological disease in more than 150 species of birds and mammals, including humans. As part of a larger investigation into the ecology of this parasite in southern Ontario, Canada using more than 1500 raccoons submitted to the Canadian Wildlife Health Cooperative over 4 years, we compared the effect of urban and agricultural land use on the prevalence and distribution of *B. procyonis*. After fitting a multivariable mixed effects model to identify animal-level and environmental

factors associated with the prevalence of *B. procyonis* infection in raccoons, we identified significant interactions between human land use type (i.e., developed or agricultural) and host sex and age. Additionally, using the spatial scan statistic, we identified a significant cluster of high infection prevalence of *B. procyonis* in raccoons centered on the Greater Toronto Area, a large metropolitan area in Southern Ontario. Our work suggests that anthropogenic environmental factors influence the prevalence of this infection in raccoons. These findings also have implications for public health and therefore may aid in the development of risk mitigation and public education strategies.

STRATEGY TO UNDERSTAND NEW VIRAL SPECIES IN WILDLIFE.

Tracey Goldstein, One Health Institute, School of Veterinary Medical, University of California Davis, tgoldstein@ucdavis.edu.

Most emerging infectious diseases in people originate in wildlife and have arisen in the developing world. Population growth and environmental change bring people into contact with wildlife frequently and in unprecedented ways, yet impoverished countries often lack the resources and infrastructure necessary to detect and respond to these diseases. In order to respond to and prevent the emergence of novel infectious diseases, we must identify them at their source. The US Agency for International Development's PREDICT project consortium designed and implemented a targeted, risk-based surveillance strategy based to detecting viruses early, at their source, where intervention strategies can be implemented before there is opportunity for spillover and spread in people or food animals. Our approach employs integrated risk modeling, molecular diagnostics, intensive population studies, and capacity building to detect known and novel viruses. Since the emergence of SARS-Coronavirus and MERS-Coronavirus it has become increasingly clear that bats are important reservoirs of viruses that spillover into people.

NOT A CAKEWALK: INSIGHTS INTO MOVEMENT OF LARGE CARNIVORES IN HUMAN DOMINATED LANDSCAPES IN INDIA.

Bilal Habib, Wildlife Institute of India, bh@wii.gov.in; Pallavi Ghaskadbi, Shaheer Khan, Zehidul Hussain, Nilanjan Chatterjee, Parag Nigam, Wildlife Institute of India.

Large carnivore conservation remains a massive challenge across the world. Owing to the wide-ranging habits, the species encounter various anthropogenic pressures which may potentially lead to wildlife human conflict. Studying the characteristics of large carnivore movement across dynamic landscape with and without human pressures is vital for management and conservation policy. We quantified the fundamental movement parameters of four large carnivores in and outside protected areas in India (tiger, leopard, dhole and wolf). We then tested the effects of human pressures like human density, road density and land use types on the movement of the species across the landscape. Our findings suggest that the mean hourly displacement of 4 large carnivores differed across habitats. Mean displacement of large carnivores varied from 77.58 m/h for leopards to 665.3 m/h for wolves. Tigers outside PAs exhibited higher displacement as compared to tigers inside PAs. Displacement during day and night were significantly different for tigers inside and outside PAs, and wolf whereas no difference was

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found for leopard and dholes. The movement and ranging patterns of species outside PAs were influenced by anthropogenic factors such as human population, road network density, and land use types. The range of the core area sizes was greater for species outside PAs (tiger and wolf) in human altered landscapes. Our study attempts to extend theoretical concepts to applied management problems and can be a starting point for rigorous studies on interlinking animal movement and landscape management for large carnivore conservation and policy making in the Anthropocene.

FACTORS INFLUENCING INTRASPECIFIC VARIATION IN FEMALE BLACK BEAR BEHAVIOR IN THE HUMAN-DOMINATED LANDSCAPE.

Don W. Hardeman Jr., University of Florida, Florida Fish & Wildlife Conservation Commission, donhardemanjr@gmail.com; Robert A. McCleery, University of Florida; Robert J. Fletcher Jr., University of Florida; J. Walter McCown, Florida Fish and Wildlife Conservation Commission.

Human population growth and development has led to increased human-bear interactions. These interactions can ultimately modify a bear's behavior, however, there are considerable gaps in our understanding of the behavioral effects of human disturbance stimuli on black bears. Developing an understanding of the intraspecific variation in factors affecting bear behavior in response to human disturbance is an important first step in addressing human-bear conflict. We investigated how differences in bear physiology, movement patterns, and food choices might explain variation in bear behavior. We performed a suite of behavioral treatments on female black bears to quantify their response to human disturbance. We classified bears as wild or developed based on the average impervious surface utilized within home range areas. We identified the behavioral change point to determine the point in time when bears responded to human approach. We quantified the change in average step length and tortuosity pre and post treatment and flight initiation distance to determine whether individuals spending more time in forested environments compared to developed areas would exhibit a stronger response to human disturbance. We then built models to determine if differences in responses to each treatment could be explained by bears' individual differences in physiological factors, diet, or movement behaviors. We found that while all individuals responded to human disturbance stimuli, bears frequently interacting with the human-dominated landscape exhibited a lessened response compared to conspecifics primarily utilizing forested environments.

OPERATION CHECKERSPOT: THE RETURN OF A MISSING BUTTERFLY TO THE PRESIDIO OF SAN FRANCISCO.

David Harelson, Presidio Trust Biological Science Technician (Wildlife), dharelson@presidiotrust.gov; Jonathan Young, Presidio Trust Wildlife Ecologist.

The Variable Checkerspot (*Euphydryas chalcedona*) was last recorded in the Presidio of San Francisco in 1978. After more than 20 years of native plant restoration, this former military base turned National Park recently reintroduced this extirpated butterfly. A suitable source

population was identified and a comprehensive plan was developed through the collaboration of a variety of local experts including artists and scientists. Beginning in early spring of 2017, fifteen hundred larvae were collected from a virile population eight miles south of the city and released throughout three sites in the Presidio. Release sites contain substantial amounts of Bee Plant (*Scrophularia californica*) and Sticky Monkey Flower (*Mimulus aurantiacus*), two of several known checkerspot host plants. Beginning in April 2017 the first Checkerspot in forty years was seen on the wing in this urban park. For the next six weeks pre-defined timed transects were meandered by staff and interns and checkerspot numbers recorded. During these counts checkerspot were seen copulating and newly hatched progeny were observed on host plants. In 2018 the collection process was repeated and the peak highest count showed a significant increase of 75% compared to 2017. Translocation efforts will not occur during the 2019 season, though continued adult monitoring will determine the need for future larval collections. Although it is still early, initial signs indicate a solid establishment and evidence has been found of dispersal to additional patches. The checkerspot story has generated significant excitement among many local urbanites once unaware of nature in the city.

MICHIGAN ZOOMIN: PARTNERING WITH THE PUBLIC TO STUDY MICHIGAN'S CARNIVORE GUILD.

Nyeema C. Harris, Applied Wildlife Ecology Lab, Ecology and Evolutionary Biology, University of Michigan, nyeema@umich.edu; Rumaan Malhotra, Applied Wildlife Ecology Lab, Ecology and Evolutionary Biology, University of Michigan.

The use of remote cameras to study animal populations remains a growing field in ecology. In the Applied Wildlife Ecology (AWE) lab at the University of Michigan, we deploy cameras across vast geographic scales to study mammalian carnivores. After laborious field efforts then emerges the new challenge of processing millions of images. To assist, we created Michigan ZoomIN, a virtual public science platform to crowdsource identifications of images obtained during our surveys. Additionally we developed programming to solicit public and K-12 engagement to build a learning community. Each image is classified by 15 different users then explore various consensus algorithms to obtain a final classification that is confirmed by the research team. Thanks to participation from >3,000 volunteers, we obtained >655,305 classifications of images from season #1. We obtained consensus for 40310 images with ~15% false positives (i.e., empty image) and other 8% requiring further review. No consensus from publically-classified data were obtained for beaver (*Castor canadensis*), cougar (*Puma concolor*), gray fox (*Urocyon cinereoargenteus*), mink (*Neovison vison*), marten (*Martes americana*), and Canada lynx (*Lynx canadensis*). We will revise our educational material on Michigan ZoomIN to improve classifications of these "difficult species". Ultimately, Michigan ZoomIN proved an effective tool for engaging the public and reduced our workload for image processing (though time for development was substantial). Despite less reliable identifications for our target species, filtering out false-triggers (5,931 images) and deer (22,124 images) represented a significant contribution from our volunteers to investigating carnivore community throughout the state of Michigan.

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BIRD CITY TEXAS: RECOGNIZING MEANINGFUL URBAN WILDLIFE CONSERVATION.

Richard Heilbrun, Texas Parks & Wildlife Department, richard.heilbrun@tpwd.texas.gov.

Texas Parks & Wildlife Department and Audubon Texas recently launched a new urban wildlife recognition and certification program. Bird City Texas encourages, promotes, and recognizes land stewardship and community engagement that improves native bird habitat and engages residents and elected leaders with habitat management, wildlife education, bird recreation, community science, and reducing threats to birds and other wildlife. The new program sets a high standard for urban communities to manage their wildlife habitat, prevent death and injuries to birds, and engage and educate their citizens, expecting municipalities to rise to meet those standards and then pursue even more conservation excellence. We discuss the results of our first year, and highlight successes and lessons learned in launching a new statewide initiative.

WILD MAMMALS AND THEIR PATHOGENS IN LOS ANGELES COUNTY, CALIFORNIA.

Sarah Helman, University of California, Los Angeles, sarahkh@ucla.edu; Katherine Prager, Jessica Lynch-Alfaro, Anthony Friscia, Christopher Kelty, James Lloyd-Smith, University of California, Los Angeles.

Urban wildlife can harbor and transmit pathogens with the potential to affect humans and domestic pets, yet little is known about the abundance, population dynamics and pathogen loads of urban mammals in Los Angeles County. To address existing knowledge gaps, we are conducting a 3-year pathogen survey of five common mammal species (coyotes, raccoons, skunks, opossums and squirrels) that may carry zoonoses (e.g. *Giardia* and *Cryptosporidium* spp.) and pathogens of conservation concern (e.g. canine distemper virus – CDV). To assess infections, we analyzed feces for pathogen DNA by PCR in carnivores (n=25 tested to date; pending=63), with positive results for CDV (n=4), *Salmonella* (n=4), *Cryptosporidium* (n=2) and *Giardia* (n=3). We assessed prior *Leptospira* exposure via microscopic agglutination testing (n=186 tested to date; pending=134) and active infections using *Leptospira* PCR (n=219 tested to date; pending=65). *Leptospira* exposure was detected in coyotes (23%, n=35), Northern raccoons (36%, n=50), fox squirrels (41%, n=44), striped skunks (23%, n=13) and one Virginia opossum (2%, n=44). We detected active *Leptospira* infections in coyotes (4%, n=53), Northern raccoons (5%, n=20), striped skunks (13%, n=15) and Virginia opossums (2%, n=51), but not in fox squirrels (n=68). This study provides an initial assessment of pathogens of zoonotic and conservation concern in LA County mammals. During this 3-year survey, pathogen occurrence will be mapped in relation to indices of urbanization to gain a qualitative understanding of pathogen distribution across this urban landscape, informing local wildlife, veterinary and public health agencies about pathogen occurrence and transmission potential in these urban mammal populations.

BIRD WINDOW COLLISIONS IN PORTLAND OR: CASE STUDY AND POLICY.

David Helzer, City of Portland Environmental Services, Portland, OR, USA, david.helzer@portlandoregon.gov.

Bird window collisions are among the top anthropogenic threats to bird populations in North America, with an estimated 365-988 million mortalities per year in the United States. Neotropical migratory songbirds, such as warblers, thrushes, and vireos, are disproportionately affected by window collisions, and as a group a priority for conservation. Portland case study: we evaluated bird window collisions at a new low rise building in Portland Oregon owned by the City of Portland. We found a rate of 125 strikes per year resulting in an estimated 75-100 annual avian mortalities, a rate five times the published national average for buildings of this type. The city retrofitted the windows with a specialized window film to reduce or eliminate collisions. We are 9 months into a yearlong post-retrofit study to evaluate the film's efficacy and we will report results. Portland policy: to address the hazard glass poses to native bird populations, the City of Portland Council adopted a new set of rules in 2018 requiring bird safe glazing on new buildings and major remodels in the central city core. Details of the bird safe glazing requirement will be discussed along with the rationale for each element.

PROTECTING NESTING BIRDS: AN MBTA COMPLIANCE STRATEGY FOR CITY GOVERNMENT.

David Helzer, City of Portland Environmental Services, Portland, OR, USA, david.helzer@portlandoregon.gov.

The City of Portland implements a wide range of infrastructure, maintenance and habitat enhancement projects that have potential to adversely impact wildlife, including nesting native birds. Vegetation management, in-stream grading, culvert replacement and wetland grading are key methods used to advance ecological restoration and enhancement. Similarly, utility projects and park maintenance often necessitate impacts to trees, vegetation and other bird nesting habitat. The timing of this work often presents a conflict with the native bird nesting season. Numerous avian species have been documented nesting in ubiquitous invasive species such as reed canary grass (*Phalaris arundinacea*) and Himalayan blackberry (*Rubus bifrons*). Songbird and waterbird nests concealed in native or non-native vegetation are easily overlooked and vulnerable; vegetation clearing can disrupt or destroy nests containing eggs or nestlings. This threat can be amplified in the urban environment where project sites offer the only habitat available on the local landscape. Harming wildlife resources is typically inconsistent with project goals and community values. In addition, eggs and nestlings of nearly all native birds are afforded legal protection under the federal Migratory Bird Treaty Act (MBTA). The City of Portland Environmental Services has developed a detailed set of best management practices to address these conflicts and protect bird nests. These have been field tested and implemented for eight years without compromising project outcomes. Strategies include avoiding specific nesting windows, surveys and phasing work around known nests.

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COLLABORATING ACROSS POLITICAL BOUNDARIES: CONSERVING WILDLIFE HABITAT IN THE GREATER PORTLAND, OREGON METROPOLITAN REGION.

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In 2012, over 100 people collaborated to create the Portland-Vancouver Regional Conservation Strategy (RCS). The region encompasses approximately 2,800 square miles in Oregon and Washington, supports 2.1 million people, and harbors a rich diversity of fish, wildlife, and habitats. Approximately 30 cities lie within the RCS boundary, plus world-class farm and forest lands. The Strategy identified mapping and conserving imperiled Oregon white oak (*Quercus garryana*) habitats and wildlife connectivity as top priorities. Accordingly, Metro, the Urban Greenspaces Institute and many partners formed two working groups to help accomplish these goals. To date, the Oak Prairie Work Group, formed in 2012, has created a detailed oak map with help from community scientists, authored a Strategic Action Plan, and is in the process of identifying regional conservation priorities. Only about ten percent of known oak locations are currently protected. The Regional Habitat Connectivity Work Group, formed in 2016, is using a new habitat "Connectivity Toolkit" created by Portland State University researchers to map and help prioritize wildlife connectivity zones for conservation. The Toolkit uses surrogate species' literature-derived GIS models to represent habitat and connectivity needs for many of the region's native wildlife species, followed by fieldwork to assess habitat conditions and potential barriers to wildlife movement. The Connectivity work group is creating a Strategic Action Plan and will identify regional connectivity zone priorities. Collaboration takes time, but creates buy-in from partners, increases funding opportunities for those working in priority areas, and enables multi-scale planning necessary to sustain the region's biological diversity.

A ROLE FOR FERTILITY CONTROL IN THE MANAGEMENT OF SUBURBAN KANGAROO POPULATIONS IN AUSTRALIA.

Catherine A. Herbert, The University of Sydney, Australia, catherine.herbert@sydney.edu.au.

Kangaroos are internationally recognised as quintessentially Australian and their presence within the coastal environment is generally seen in a positive light. However, new management challenges are increasingly occurring in coastal towns as human populations and infrastructure encroach on kangaroo habitat. This juxtaposition of high-density kangaroo populations and suburban development causes a myriad of issues which can affect the welfare of both kangaroos and people. These management challenges are amplified by strong local opinions about appropriate management actions, with non-lethal control being viewed as highly desirable, if not essential, in these areas. In this presentation I will highlight the key impacts of overabundant kangaroo populations in coastal suburbs, including the significant effect that fragmentation can have on animal health and welfare. I will also discuss new innovations in the development of remote contraceptive delivery technology and how these are being incorporated into local management programs. Finally, I will propose a framework highlighting the situations

in which fertility control is most likely to be a viable population management tool and the challenges for future widespread use of this approach in medium-sized terrestrial mammals in suburban areas more generally.

THE BOOM AND BUST BUTTERFLY: FINDING A WAY FOR THE QUINO CHECKERSPOT.

Paige Howorth, San Diego Zoo Global, phoworth@sandiegozoo.org.

First listed as federally endangered in 1997, the quino checkerspot butterfly continues to face numerous threats to sustainability, including climate change and habitat loss due to development. Its population abundance in times of adequate rainfall and virtual disappearance amid drought conditions—an increasingly new “normal” for its Southern California habitat—have challenged recovery strategies for decades. San Diego Zoo Global joined with the U.S. Fish and Wildlife Service in 2013 to create a captive rearing and monitoring program for potential reintroductions of this elusive San Diego native. Given the unique biology of the quino checkerspot butterfly and its scarcity during the drought of 2012-2015, the program required flexibility and innovation from the start. To guide our work, we sought to answer the following questions: what is the best strategy for rearing large numbers of larvae, and how can we provide the most accurate inputs in a laboratory environment? What is the best life stage for the release of this butterfly, and what methods will we employ for release and monitoring? Finally, upon release, how do we measure success and plan for the future, given the natural variability of the butterfly’s populations? After two successive years of releases, more than 8,000 larvae and a multitude of changes along the way, we have some unexpected answers that show promise for the recovery of this resilient butterfly.

THE TICK LICK: IMPROVING HOST TARGETED BAITED TICK TREATMENT FOR PUBLIC AND PRIVATE USE.

Grace Hummell, University of Maryland, Department of Environmental Science and Technology, College Park, MD, ghummell@umd.edu.

Rates of vector-borne diseases in our environment have been increasing over time due to climate change, loss of habitat, and increased suburbia. Management reducing the risk of vector-borne diseases is starting to incorporate host species control. In the United States, one of the most prevalent vector-borne diseases is Lyme disease. The current treatment for host species, such as white-footed mice and white-tailed deer, involves species specific baited treatment that uses a tickicide. Although tick treatments have been found to reduce tick density, due to expense and practicality of these current treatments they are not able to be used by the everyday consumer. Another issue noted while using these tick treatments are the mass amounts of calories pumped into an ecosystem, which in some cases can support large populations of suburban deer. In our current tick control study, 4-poster feeders used a total of 30,495 lbs. of corn over a 7-month period, which roughly cost \$5,000. The Tick Lick was created to improve upon some of the major faults found in current treatment. The Tick Lick tries to target multiple host by using food/mineral blocks that cost less over time (one block lasting up to 6 months) and do not use large quantities of corn. The Tick Lick is also 3x smaller than the 4-poster feeder, making it lightweight and something that the average homeowner could use

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in their yard. A pilot study of the design was found to be successful with attracting and treating multiple species, but was more heavily used by deer. Future research will investigate deer and other wildlife use of the Tick Lick across a human population gradient (urban, suburban and rural). The goal is to be able to document overall wildlife use, suggest the best type of bait to use in each environment, and ultimately make a tick control treatment that is easy to use by many different types of consumers.

USING CAMERAS TO UNDERSTAND WILDLIFE PATTERNS IN A MID-SIZED AMERICAN CITY.

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Madison is the capitol city of Wisconsin with a population of roughly 255,000 people. Representative of medium-sized cities in the United States, Madison consists of mixed zoning with varying densities of buildings, impervious surfaces, and natural areas. Madison is part of the Urban Wildlife Information Network (UWIN), a collaboration started by the Urban Wildlife Institute at the Lincoln Park Zoo to employ a similar methodology to place wildlife cameras along urban to less urban gradients in cities across North America. We are developing models with mammal diversity and relative mammal size (small, medium, and large) as the response variables and using predictor variables about the built environment and human use of the urban landscape to understand how wildlife patterns change with changing human and development densities. We expect to be able to offer suggestions about managing wildlife in a mid-sized city and how urban planning decisions may affect wildlife patterns.

ANIMAL ROAD CROSSINGS: RECONCILING HUMAN AND ANIMAL MOBILITY IN URBANIZING LANDSCAPES.

Sandra Jacobson, US Forest Service (retired), sandrajacobson@ymail.com; Renee Callahan, ARC Solutions.

Reconciling our relationship with wildlife in and around our cities is a contemporary planning and design challenge precipitated by expanding urban regions and road networks across North America. The development and expansion of roadways is associated with an increase in observed wildlife-vehicle collisions in the short-term, as well as the long-term effects of landscape fragmentation including habitat degradation and declines in biodiversity. Resolving this complex and interdisciplinary challenge requires an integrated approach that addresses: communicating the need for connected landscapes, generating new designs and approaches for enhanced landscape connectivity and enhancing collaboration between experts from across the disciplines of ecology, architecture, landscape design, engineering and transportation planning. Beginning by launching the first-ever design competition to create a new generation of cost-effective, ecologically responsive, and readily adaptable wildlife crossing infrastructure for widespread implementation, ARC Solutions has worked to advance the deployment of

crossing infrastructure through education, innovation, and collaboration. This session shares insights from a decade of efforts in the effective translation of research to practice and the advancement of safe passages for humans and wildlife. Learn how agencies and practitioners can overcome barriers to the implementation of crossing infrastructure, the benefits of nationwide commitment to connected landscapes, and strategies for integrating connectivity at the urban scale using innovative materials and implementation strategies.

PRIORITIZING CONNECTIVITY UNDER CLIMATE CHANGE: UNCERTAINTY AND OPPORTUNITY.

Megan Jennings, San Diego State University, mjennings@sdsu.edu; Emily Haeuser, San Diego State University; Erin Conlisk, Point Blue Conservation Science.

Maintaining regional biodiversity and ecological function of natural landscapes in the face of a changing climate coupled with ongoing land use development is one of the central and burgeoning issues facing land managers. To preserve biodiversity and address issues of fragmentation, ecological networks, intended to protect connected patches of habitat, are being implemented in many regions of the world. Landscape connectivity allows for movement among patches of suitable habitat, reduces the chance of extinction for small populations, maintains gene flow in patchy landscapes, and protects populations against catastrophic risks, such as fire. Over longer time scales, connectivity will also prove critical for facilitating range shifts in response to landscape changes. In this project, we applied cutting-edge approaches and best-practices to advance regional-scale climate-smart connectivity planning in southern California using a scenario-based approach to support decision-making under uncertainty. Employing a complementary set of analyses including ensemble species distribution models (SDMs), dynamic metapopulation models, and multifaceted connectivity modeling, we developed a regional connectivity strategy that would account for climate change, land-use shifts, and uncertainty. An implementation guide and decision support framework were created to aid in the identification and prioritization of land acquisition targets, land management goals, and habitat enhancement projects to protect and improve landscape linkages that will be resilient to climate change. This work will support the establishment of feasible and adaptive approaches to retain landscape connectivity and resiliency and will support biodiversity within ecological networks and across the region.

FORAGING BEHAVIOURS IN URBAN SMOOTH-COATED OTTERS IN SINGAPORE.

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Smooth-coated otters (*Lutrogale perspicillata*) returned to Singapore recently after decades of absence, partly in response to improved water quality. Currently more than ten families of otters live in and around Singapore, some with more than a dozen individuals. A loose community of otter watchers photograph and video-record the otters' behaviours primarily for their own entertainment. However, the presence of otter watchers means that some otter families are very habituated to humans, and consequently an enormous amount of biological and ecological information is being recorded. Here we present results from a combination of academic and citizen science on the behaviours of smooth-coated otters with respect to foraging. Smooth-

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coated otters are cooperative breeders, typically with a single breeding pair, where older offspring help care for younger pups. Otters sometimes forage cooperatively by “herding” fish. We present evidence that otters forage cooperatively not for reasons of efficiency but as a means of training pups to hunt. We also present preliminary data on individual otter foraging with relationship to optimal foraging theory. We discuss both these findings in the context of other animals, including other marine and aquatic mammals, in terms of the cooperation and conflict in this species, and the implications to urban wildlife more generally.

PREDATOR EXCLUSION AND EDUCATION PROGRAM (PEEP).

Natalie Jones, Sonoma County Wildlife Rescue, Pelaluma, CA, PEEP@scwildliferescue.org; Doris Duncan, Sonoma County Wildlife Rescue.

The Predator Exclusion and Education Program (PEEP) is an innovative program designed to help people with conflicts between domestic and wild animals. By providing a physical learning lab, students and members of the community can learn ways to protect their livestock and pets from natural predation in ways that do not harm wildlife, so the ecology of the region can remain balanced. Run by Sonoma County Wildlife Rescue, PEEP is designed to mitigate the impact humans have on wild animal populations and enable frustrated members of the community to find effective non-lethal solutions to their predation problems. In addition to the existing agricultural businesses in Sonoma County, many hobbyists participate in urban farming and the keeping of pet chickens. Without traditional agricultural knowledge about the security needs of livestock, many of these hobby farmers experience unnecessary losses due to predation. The PEEP program remedies this with examples of safe and effective structures, directions on building of these structures, and humane wildlife deterrents. With this program in place, we expect to reduce the number of wildlife fatalities and injuries related to livestock predation, spread knowledge of effective humane predation prevention techniques in our community, and encourage youth to respect both domestic and wild animal needs. We are the first wildlife rehabilitation center in the USA to implement this kind of program. We feel the program will go beyond the individual animal needs of wildlife rehabilitation and provide an opportunity for systemic change by addressing the root of the problem.

CAMERA TRAP AND COMMUNITY SCIENCE OBSERVATION DATA PAIRED WITH LANDSCAPE RESISTANCE MODELING IDENTIFIES MAJOR URBAN WILDLIFE CORRIDORS.

Roshni Katrak-Adefowora, Department of Biology, Occidental College, rkatrakadefo@oxy.edu; Barbara Goto, Arroyos & Foothills Conservancy; Mark Duttweiler, Applied Invention; Lizbeth Plego, Arroyos & Foothills Conservancy; Andrew Pham, Arroyos & Foothills Conservancy; Amanda J. Zellmer, Occidental College.

The establishment of a wildlife corridor can have a significant positive impact on wild animals in fragmented habitats, but identifying where corridors will be best utilized requires an understanding of how landscape variables shape the movements of animals. In this study,

we combined landscape resistance modeling with both community science and camera trap observational data in a model selection approach to test alternative corridor models. We focused on six different urban wildlife species, including: puma, bobcats, coyotes, deer, skunks, raccoons, and possums, through a major urban corridor in the greater Los Angeles area. We tested four alternative models comprised of imperviousness and forest cover against a null using AIC scores. Models were validated using camera trap data from the Urban Wildlife Information Network (UWIN). We identified the best-fit model for each species and then combined the models to determine optimal corridor regions across the full species set. Our results demonstrate the utility of this approach for identifying high quality habitat for implementation, management, and conservation of wildlife corridors.

EFFECTS OF URBANIZATION ON NATIVE BIRD ASSEMBLAGES IN THREE SOUTHWESTERN US CITIES.

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Urbanization presents novel challenges to native species by altering both the biotic and abiotic environments. The rapid pace of declines in species diversity and ecosystem services makes generalizations imperative. Studies have attempted to make generalizations about how species with similar traits respond to urbanization, although the results of such studies are geographically idiosyncratic. Here, we present a comparative study in three US cities, Fresno, California; Tucson, Arizona; and Phoenix, Arizona in an attempt to examine consistency in how urbanization affects native bird assemblages. Using presence-absence data to define regional species pools and urban assemblages, we tested whether the urban avian assemblage is a random subset of the regional avian assemblages on the basis of both traits and phylogeny, and whether or not urbanization causes biotic homogenization among avian assemblages. We found some evidence for non-random trait shifts, in distributions of diet guilds, migratory status, and main habitat, but no evidence for non-random phylogenetic patterns in urban avian assemblages. In addition, species in the urban species assemblages have a higher median reporting frequency than all species in the regional species pools in all three cities, although this difference is statistically significant in only one city. These results indicate that while urban avian assemblage structure may be determined in part by species' traits, simple occurrence in an urban area is likely also due to neutral dispersal processes.

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LA ANIMAL STORIES: STUDYING ONLINE CONVERSATIONS ABOUT WILDLIFE TO UNDERSTAND EMOTIONS, MORAL COMMITMENTS, AND EVERYDAY SOLUTIONS.

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We report on the results of a systematic anthropological study of conversations about interactions with wildlife in the city of Los Angeles. We catalogued over 150 conversations about wildlife (primarily mammals including coyotes, possums, skunks, raccoons, mountain lions, squirrels, bobcats, mice and rats) that take place on a popular app for interacting with local neighbors. We analyze the structure, progression, and content of the conversations to look for evidence of three things: 1) immediate expressions of emotional reaction (fear, concern, wonder, enchantment, disgust); 2) proposed solutions to problematic encounters, ranging from routine pest control to strategies for human and pet safety; and 3) “moral orders” that we interpret as underlying the commitments of conversation participants.

LIVING IN THE ANTHROPOCENE: SPACE-USE AND MOVEMENT OF INDIAN GREY WOLF.

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Indian wolf (*Canis lupus pallipes*) is the top predator of the open-plains of India and occupies large areas within human-dominated landscape. Schedule I species as per (Wildlife (Protection) Act, 1972), was once distributed across the country but is now restricted to small fragmented populations due to various anthropogenic factors. To facilitate the conservation of this endangered canid, it is critical to gain insights about its basic ecology such as movement and space-use in the continuously changing landscape. The study was conducted from December-2017 to August-2018 in semi-arid landscape of Maharashtra, exclusively in Pune and Solapur Districts. Four wolves of three different packs were captured from Solapur (W1-Female and W2-Male), and Pune (W3-Female and W4-Male), using soft-catch leg-hold traps and fitted with GPS-Plus Vectronics radio-collars. Movement parameters of three individuals were calculated and their homerange was estimated using Brownian-Bridge Movement Model (BBMM). The average displacement of W1 and W2 was found to be higher than W3. Total displacement of W1 and W2 was found higher during night than daytime whereas, no difference was found in day-night movement of W3. The homerange of W1's pack was found 258km²(95% BBMM) with core area of 32km²(50% BBMM). The homerange of W2's pack was 400km², within which the pack had five clusters core areas of average size of 8km². The homerange of W3's pack was the smallest (59km²) with core area of 6km². The movement information generated from radio collaring is critical for devising long term conservation and management policies for species in human-dominated landscape.

INATURALIST CAN GUIDE POLICY: EXAMPLES IN DALLAS/FORT WORTH.

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How can a community science observation guide policy? A single dot on a map is not incredibly informative, but when it is combined with many other dots, then some patterns may develop. With the use of citizen science, this mass of dots can be utilized not just by research scientists of interested naturalists but also by public land managers. Observations show policy makers that there is an active constituency of individuals that document changes over time. These observations give guidance to public land management that city councils, park boards, and interested parties can use. This presentation will introduce how iNaturalist observations are actively being used in Dallas/Fort Worth, Texas to guide management and produce meaningful conservation policy.

CATIO TOUR: A HUMANE AND EFFECTIVE STRATEGY FOR PROTECTING BIRDS AND CATS.

Karen Kraus, Executive Director, Feral Cat Coalition of Oregon, kkraus@feralcats.com; Bob Sallinger, Conservation Director, Audubon Society of Portland.

The Audubon Society of Portland and Feral Cat Coalition of Oregon have been working together for more than two decades to develop humane and effective strategies to reduce free-roaming cats and protect birds from cat predation in the Portland Metro Region. One of the primary strategies the partnership has used to accomplish this goal is a highly effective Catio Tour which has occurred annually since 2013. Portland was the first city to pioneer this concept and remains the largest tour, but cities across the US and Canada are now replicating this type of event. The Catio Tour is a one day event in which community members register to take a self-guided tour of outdoor cat enclosures that people have constructed at their homes and businesses. Participants have the opportunity to see a wide range of catios in terms of both style and cost and to speak with experts at each site with the goal of inspiring participants to construct their own catios. Our survey results from attendees reflects the growth trend in interest in Catios, intent to build, and the prominence of interest throughout the Portland area. Every year of the Catio Tour has sold out with more than 6,600 people attending overall and 1,300 touring last year alone. Of these guests, 73% are likely to build a catio and 89% are likely to attend a future tour. The Catio Tour has proven to be a very effective way to engage the community in protecting birds and cats and Audubon and FCCO have been developing auxiliary strategies to promote the Catio concept year round.

ECOLOGICAL CHARACTERISTICS OF BEE COMMUNITIES IN URBAN GARDENS.

Gail Langellotto, Oregon State University, Corvallis, OR, Gail.Langellotto@oregonstate.edu.

Urban gardens have the potential to act as important habitat for bee communities, by provisioning forage and nesting sites. However, depending upon the plant palette and management practices used by gardeners, gardens also may act as an ecological filter (excluding specific taxa or functional groups). Data from studies of garden bee diversity in the United States were reviewed to better understand 1) the number and types of bee species that have been collected from gardens, and 2) the ecological characteristics of garden bees. Ten studies of bee communities were found in urban gardens that both identified most bees

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to the species level and for which a non-garden comparison study in the same eco-region was available. A variety of natural history papers, journal articles and online databases were consulted to define the ecological characteristics, taxonomic family, origin (native or exotic), nest substrate, floral specificity, and sociality, of garden and non-garden bees. Across these studies garden studies, more than 200 bee species have been collected. We found that urban gardens have fewer spring-flying bees and fewer soil nesters compared to non-garden sites. There are several potential explanations for this pattern including less availability of spring-blooming trees and other plants in gardens, and lack of nest site availability for soil-nesting bees.

URBANIZATION AND ITS EFFECTS ON RESOURCE USE IN COYOTES IN SOUTHERN CALIFORNIA.

Rachel Larson, California State University Northridge, RLarson92@gmail.com; Justin Brown, National Park Service; Seth Riley, National Park Service; Tim Karels, California State University Northridge.

As humans increasingly develop and inhabit urban areas, the number of species coming into contact with us is increasing. In addition, urbanization can change the distribution and availability of resources such as food. The increased availability of anthropogenic resources is an often cited but poorly understood mechanism believed to attract and sustain wildlife populations in cities. Southern California is one of the largest urban areas in the United States, yet populations of mammalian carnivores, such as coyotes (*Canis latrans*), still persist there. Studying the diet of urban coyotes will help us understand how these carnivores colonize and persist in human-dominated landscapes and how they influence urban ecosystems. Our goal is to describe the diet of coyotes living in the urban areas of Los Angeles and draw comparisons to surrounding suburban Thousand Oaks and rural agricultural areas. We collected scat data from 47 transects to assess population-level trends and whiskers from 19 collared individuals and 42 carcasses for stable isotope analysis. Anthropogenic items are a common occurrence in urban coyote scats (65% of scats). This is in contrast to the suburban population, where the occurrence of natural prey items is far more common (83% of scats) compared to anthropogenic items (38% of scats). On an individual level, isotopic signatures vary with urbanization levels, with urban coyotes consuming mostly anthropogenic foods, rural coyotes consuming mostly natural foods, and suburban coyotes exhibiting the greatest variation. Increasing our knowledge of urban coyotes will further our understanding of their role within urban ecosystems.

COMPARING BIOTIC AND ANTHROPOGENIC DRIVERS OF BAT SPECIES DISTRIBUTIONS IN CHICAGO: WATER, FOREST, BUILDINGS, AND NOISE.

Elizabeth Lehrer, Lincoln Park Zoo, llehrer@lpzoo.org; Travis Gallo, Mason Fidino, Seth Magle, Lincoln Park Zoo.

Bats are common inhabitants of cities yet we know little about the factors that drive their

distributions. As bats face many threats (e.g., white nose syndrome, wind energy development), it is critical to understand how they use urban areas to effectively manage and conserve them. From 2013–2017 in Chicago, Illinois we placed acoustic detectors at 25 sites along a gradient of urbanization to record both echolocation calls and ambient sound. Using Bayesian occupancy models, we examined the influence biotic factors (i.e. distance to open water, tree canopy cover, and forest edge) and anthropogenic factors (median sound pressure level of ambient noise, building height, building density, and the complexity of building heights) on the presence or absence of 7 bat species. Bats were influenced by both biotic and anthropogenic factors, but the strength of the response varied by species. The strongest predictors of occupancy for most bat species were distance to water and sound pressure level. Covariates describing forest cover and building morphology did not have a strong influence on occupancy for most species. For several species, occupancy decreased as distance to nearest water source increased, and bats avoided sites with high ambient noise, even those that were directly adjacent to water. These results suggest that when planning for or managing bat habitat, cities should minimize development that would generate high ambient noise along waterfronts and rivers.

POISONED CHALICE? A MULTI-METHOD APPROACH TO TESTING THE EFFECTS OF URBANISATION ON THE FORAGING ECOLOGY OF CAPE PENINSULA CARACAL.

Gabriella Leighton, Institute for Communities and Wildlife in Africa, gabi.leighton1@gmail.com; Jacqueline Bishop, Institute for Communities and Wildlife in Africa; Joleen Broadfield and Justin Johnson, Cape Leopard Trust; Graham Avery and Margaret Avery, Iziko Museums of South Africa; Justin O’Riain and Laurel Serieys, Institute for Communities and Wildlife in Africa.

In increasingly urbanised diversity-rich regions apex carnivores can be powerful indicators of environmental threats. While there are many novel risks to urban wildlife, some highly adaptable mesocarnivore species may benefit from subsidised resources around cities through dietary flexibility. However, this attractive increase in resources has concomitant costs that are often undetectable, such as exposure to environmental toxins. This can lead wildlife to fall into an ‘ecological trap’. Dietary studies highlight possible toxicant contamination routes that make urban foraging maladaptive. We use a combination of several methods to investigate the diet of the caracal (*Caracal caracal*) on the isolated Cape Peninsula increasingly surrounded by dense residential areas. We investigated ~700 GPS clusters from 23 caracals to locate prey remains and scats, and performed stable isotope analysis of fur carbon and nitrogen of over 100 individuals around South Africa. Pesticide testing of blood samples is underway. We found that Cape Town caracals have flexible diets with little urban prey, suggesting toxicant exposure is secondary or tertiary. Models indicate that caracals, particularly males and juveniles, are preferentially hunting significantly closer to urban features, which could increase their exposure risk. Preliminary analysis reveals a high degree of isotopic signature variability within the Peninsula compared with natural populations, possibly due to increased prey diversity. Early results from pesticide testing quantify the risk of these occasional visits into urban areas, with the objective of understanding if caracals, along with many other Cape Peninsula species, are caught in an ecological trap, and exploring possible management solutions.

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BAILA, A NOVEL URBAN BIODIVERSITY ASSESSMENT FRAMEWORK THAT COMBINES AN URBAN HABITAT CLASSIFICATION AND COMMUNITY SCIENCE DATA.

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We develop a novel urban biodiversity assessment framework that is quick and simple to implement, can be conducted with minimal taxonomic expertise, is scientifically credible, and can be applied in urban areas worldwide. This framework combines a customized urban habitat classification with community science generated species occurrence data to produce a spatially explicit biodiversity assessment. We demonstrate this framework by using publicly accessible data in the highly urbanized Los Angeles area. We first build an urban typology using 18 ecological and anthropogenic variables to classify lands within the Los Angeles area into nine different types that vary in biological and anthropogenic characteristics. We then use recent, research-grade occurrence data collected through the online community science platform iNaturalist to examine biodiversity patterns across the Los Angeles area, and within each urban type. The integration of an urban habitat classification with species occurrence information allows analyses of how urban heterogeneity affects biodiversity, and provides useful information for urban planning and conservation management aimed at maintaining and enhancing desirable species and ecosystem services. This framework uses publicly available remote sensing and biodiversity data that are becoming increasingly available for urban areas around the globe, especially as a result of community science initiatives. This approach requires minimal technical expertise, and it can be widely applied to other metropolitan areas pursuing biodiversity assessments, conservation planning, and urban conservation projects.

HOST-TARGETED TICK CONTROL TO REDUCE THE RISK OF TICK BITE AND LYME DISEASE IN A SUBURBAN ENVIRONMENT.

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With an estimated 300,000 cases per year, Lyme disease is the most important vector-borne disease affecting people in the United States. Most people acquired the disease from tick bites suffered during outdoor activities, such as playing and yard work around homes and hiking in wooded areas. White-footed mouse (WFM) and white-tailed deer (WTD), two important vertebrate hosts of the blacklegged tick (or deer tick) – the vector of the disease agent for Lyme disease, are abundant in suburban environment. While WTD is the main host for adult deer ticks, WFM supports immature stages of the tick and also serves reservoir for the pathogen. An USDA-led 5-year Areawide Tick Management Project is currently being carried out in Howard County, MD

to test the efficacy of integrated tick control strategies that are centered at host-targeted tick control, including 4-Poster deer bait and treatment stations and rodent bait boxes. This multi-disciplinary and multi-institutional collaboration project is expected to generate research data that can guide development of effective and cost-effective tick control recommendations that can be implemented at community level.

THE LUXURY EFFECT BEYOND CITIES: BATS RESPONDED TO SOCIOECONOMIC VARIATIONS ACROSS LANDSCAPES.

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The luxury effect describes the positive relationship between affluence and biodiversity, activity, or presence probability of organisms in urban landscapes. Driven by difference in human actions, the luxury effect should potentially scale up and be found across different landscapes. Previously the luxury effect has been found in two bat species, the red bat (*Lasiurus borealis*) and the evening bat (*Nycticeius humeralis*), in an urban landscape. We examined bat activity distribution patterns across landscapes, including both urban and non-urban areas, for 7 common bat species to test for the luxury effect. We also identified bat – land cover associations for each species. Across the state of North Carolina, USA, we used the North American Bat Monitoring Program mobile transect survey protocol to collect bat activity data for 7 species at 43 sites from 2015 to 2018. We collected land cover data from the 2011 National Land Cover Database and income data from the 2016 American Community Survey. We constructed generalized linear mixed models to identify bat-land cover/bat-income relationships. We found that across landscapes, activity of *Lasiurus borealis* and *Nycticeius humeralis* was positively correlated to income, independent of land cover, consistent with previous results from an urban landscape. We also found that hoary bat (*Lasiurus cinereus*) activity decreased with income. All 7 species had specific land cover habitat associations. Our results demonstrate that the luxury effect in urban landscapes can be found beyond cities and is an ecological pattern that can be scaled up across different landscapes. We suggest multi-scale roosting and foraging studies to identify the mechanism underlying the luxury effect. We also suggest that the luxury effect could cause inequity in ecological services provided by bats.

BIRD RESPONSE TO HABITAT RESTORATION AT A WASTEWATER TREATMENT FACILITY IN OREGON, USA.

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In 2014-15 Clean Water Services, water resources utility in the Portland Oregon metro region, implemented a massive habitat restoration project at Fernhill Wetlands in Forest Grove, Oregon that transformed 90 acres of unused sewage ponds into native wetland habitats designed to naturally treat wastewater. Since spring 2015 the Audubon Society of Portland (ASOP) has assessed bird response to this habitat restoration effort through a community science effort

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involving local birders, formal bird surveys conducted by ASOP, and analysis of historical eBird surveys conducted at the site for decades. Our general predictions were that 1) Overall avian species richness and abundance would increase, 2) Open-water dependent species would diminish in abundance, and 3) Species dependent on native wetland habitats would increase. Our key preliminary findings indicate that both species richness and overall species abundance do not appear to have changed significantly between pre- and post-restoration periods, however, at the individual species level we document significant shifts in abundance. Most of these shifts fit our a priori predictions. In general, most waterbird species (including Virginia Rail and Sora), wetland-dependent songbirds (including Red-winged Blackbird and Common Yellowthroat), and dabbling ducks (Mallard and Gadwall) have higher abundances post-restoration while wintering grebes and fall migratory shorebirds have lower abundances post-restoration. We document increasing bird abundance concomitant with vegetation reestablishment during the 3-year period following restoration. We provide evidence that community science eBird surveys and the formal transect surveys were directly comparable. Our findings demonstrate benefits to native bird communities that can be achieved through integration of green infrastructure strategies to manage wastewater.

HUMANE REDUCTION OF FREE-ROAMING CATS ON HAYDEN ISLAND: A CASE STUDY.

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The Hayden Island Cat Project is a collaboration between Portland Audubon, Feral Cat Coalition of Oregon, and others including community members working to humanely reduce the number of feral, stray, and free-roaming cats on the island. Since 2014, the group has used trap-neuter-return (TNR), pet cat low-cost sterilization, cat adoption programs, and targeted community outreach/engagement in an attempt to achieve project goals. We delineated a 486-acre portion of the island as our study area including multiple land-use types. We highlight results from the past five years including 1) Cat ownership patterns/human perceptions; 2) Road-based cat count surveys to assess population dynamics; and 3) Camera-monitoring and stable isotope analysis (results pending). Questionnaires sent to 1199 households indicate 38% of households have pet cats, with the highest percentage in the manufactured home community (MHC) (55% vs. <20% in other land-use types) and over half (52.3%) of respondents support sterilization to manage outdoor cats while 25% support removal. We used annual road-based cat survey data from 2014–2018 within an N-mixture model framework to estimate cat population dynamics. We document: 1) 12 times as many free-roaming cats detected in the MHC compared to other land-use types; 2) sterilization rate based on ear-tip information increased from ~30% to 35%; 3) Cat detection probability ranged from ($p = 0.10-0.31 \pm 0.03SE$) depending on the cat group (unclaimed, collared, ear-tipped); 4) Annual population estimates for outdoor cats indicate a stable population with no significant trend. Camera-monitoring and spatial analysis indicates almost all cats remain in the MHC although two cats were detected in natural area land-use

type. We provide a discussion of successes, challenges and next steps.

BLACKLEGGED TICK RESERVOIR HOST DIVERSITY AND ABUNDANCE IMPACTS ON DILUTION OF BORRELIA BURGENDORFERI IN RESIDENTIAL AND WOODLAND HABITATS IN CONNECTICUT, USA.

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The dilution effect in the zoonotic disease transmission cycle theorizes that an increased diversity of host species will alter transmission dynamics, result in a decrease in pathogen prevalence, and potentially lower human disease incidence. The interrelationship of *Borrelia burgdorferi*, the etiological agent of Lyme disease (LD), and its primary vector, blacklegged ticks (*Ixodes scapularis*), is a commonly used example of the dilution effect, suggesting that an increased diversity of host species will be found in large, undisturbed forested tracts and lower diversity in fragmented forests. Given that Connecticut woodlands are mature with heavy upper canopies and generally poor habitat quality, we hypothesized there would be higher diversity of host species resulting in lower prevalence of *B. burgdorferi* in white-footed mice (*Peromyscus leucopus*) in forested residential areas. Using camera and live small mammal trapping techniques, we determined there was a greater richness of reservoir host species, significantly higher encounters with hosts, and significantly lower *B. burgdorferi* host-infection in residential areas as compared to large, intact forested stands. Furthermore, we determined that the driving factor of pathogen dilution was not host species diversity, but rather overall encounter abundance with alternative hosts, regardless of habitat type. Our study challenges major concepts of the dilution effect within the Connecticut landscape and calls for new managerial actions to address the current state of our woodlands and abundance of host species in the interest of both forest and public health.

COMMUNITY SCIENCE WITH CAT TRACKER: A SMARTPHONE APP FOR UNDERSTANDING AN ECOLOGICAL CATASTROPHE.

Jason D. Luscier, Le Moyne College, Syracuse, NY, lusciejd@lemoyne.edu.

The International Union for the Conservation of Nature has labeled the domestic house cat the “world’s worst invasive species.” High populations of free-roaming house cats in cities negatively affect populations of native wildlife. Feral cat populations pose potential human health concerns (e.g., rabies and toxoplasmosis). Many cities have implemented Trap-Neuter-Release (TNR) programs in the hopes of reducing cat populations over time, but the efficacy of these programs is unclear. Cat advocate groups around the US are extremely active with cat management programs such as TNR, but communication barriers between these cat advocates and ecologists have prevented potentially useful collaborations for improving management. Ultimately, we need more information regarding effects of cats on urban food web dynamics and community structures so as to better inform management of native wildlife. One of the most effective ways to gather fine-scale data regarding cat distributions over expansive geographic

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areas is to rely on community science data. I have created a smartphone app for community science data collection regarding populations and distributions of free-roaming house cats - Cat Tracker. Not only are data gathered with Cat Tracker useful for urban wildlife research, but also these data will help local animal welfare groups with future cat management plans. One of the greatest challenges relating to this issue is education of the public. This project supplies a great opportunity for increasing community awareness as well as fostering collaborations among urban ecologists and cat advocate groups in the hopes of finding solutions to this conservation challenge.

ENGAGING WITH VETERINARIANS ON CAT MANAGEMENT STRATEGIES TO REDUCE CAT OVERPOPULATION AND CAT IMPACTS ON WILDLIFE POPULATIONS.

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Free-roaming cats present a multidisciplinary challenge for wildlife conservation and feline welfare. Veterinary professionals are critical stakeholders in the free-roaming cat issue, making it imperative that their attitudes and perspectives are well understood. We conducted a survey of veterinarians across British Columbia to evaluate their perceptions of whether cat overpopulation is a concern, the impacts of cats on wildlife and, alternative management strategies for dealing with cat overpopulation. Fifty-six percent of respondents agreed that cat overpopulation was a local problem, and 91% agreed that veterinarians play a role in reducing cat overpopulation. Veterinarians were less cohesive on their perceptions of the impact of free-roaming cats on wildlife with 53% agreeing that after habitat loss, cats are one of the most significant, direct causes of bird and wildlife mortality, whereas 30% were neutral, and 17% disagreed. Fifty-six percent of veterinarians felt that keeping cats indoors would be one of the most effective strategies to reduce cat impacts on wildlife, but they also felt that public education programs and low-cost spay-neuter programs would be effective and more popular with cat owners. Most veterinarians (79%) recommended against unsupervised outdoor access, citing safety and disease risks. Rodent control was the most common reason for not recommending an indoor lifestyle. Overall, our survey results suggest that veterinarians are committed participants in the prevention of cat overpopulation. Our next steps, in progress, include engaging with veterinary colleges and practicing veterinarians regarding the impacts of cats on wildlife.

URBAN WILDLIFE CONSERVATION IN THE US CORN BELT: MESOPREDATORS AND THEIR RELATIONSHIP TO THE URBAN ENVIRONMENT IN A SMALL AGRICULTURAL CITY.

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With the loss of large mammalian predators across much of the US Corn Belt, mesopredators

are now the top predators within these systems. These landscapes consist largely of intensive agriculture with little natural vegetation. Cities in this region, however, often contain significant urban forests, city parks, and lawns that could act as habitat for mesopredators. As such, these 'agricultural cities' are increasingly viewed as places for biodiversity conservation, and the need for conservation efforts for mesopredator species in this region is amplified due to historic losses to wildland habitat and their role in a functioning urban ecosystem. While patterns of urban biodiversity have been identified and described for many taxa, most studies are conducted in large cities. Much less is known about these patterns in small cities and those located in agricultural landscape contexts. This study explored relationships between the distribution of mesopredator species and landscape structure, vegetation, and urban intensity in Iowa City, IA, an agricultural city. Study design and data collection utilized camera trapping methodology to assess mesopredator occupancy at study sites located along an urbanization gradient. Mesopredator species in this area varied in their relationship to the variables examined. Some species exhibited negative relationships to variables such as fragmentation and impervious surfaces, while other species did not exhibit significant relationships to these factors. Many, but not all, species exhibited negative relationships with cropland extent and positive relationships to structural complexity of the urban forest. These findings can support management of urban-agricultural landscapes to support mesopredator conservation.

DISEASE SPILLOVER AMONG WILDLIFE SPECIES: HAS ANTHROPOGENIC LANDSCAPE CHANGE CONTRIBUTED TO THE RISE OF SARCOPTIC MANGE IN PENNSYLVANIA BLACK BEARS?

Erika Machtinger, Chemical Ecology Laboratory, University Park, PA, etm10@psu.edu; Hannah Greenberg, Chemical Ecology Laboratory, University Park, PA; Mark Terner, Pennsylvania Game Commission; Justin Brown, Pennsylvania Game Commission, Pennsylvania State University; Jennifer Murrow, University of Maryland, Department of Environmental Science and Technology.

American black bears in Pennsylvania are suffering from rising numbers of Sarcoptic mange infections that have resulted in increasing mortalities. In 2000, black bear with mange were reported in 60 municipalities in Pennsylvania. This number increased over 5-fold to over 300 municipalities reporting sightings of black bears with mange in 2013. The mite recently was identified as *Sarcoptes scabiei* var. *canis*, but the cause and subsequent driving mechanisms behind the host jump from canids to black bears is unknown. Anthropogenic landscape level changes including human interaction in previously wild spaces may have contributed to the spillover event. This is a multi-institution and interdisciplinary study with the objectives of exploring the spatial ecology and physiology of infected and healthy bears and performing in-depth genetic analysis of mites collected from bears and canids to determine a origin and subsequent spread of the spillover from wild canids to bears. Current objectives and results will be discussed as well as the potential role of such spillover events serving as a model for other systems.

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THE URBAN WILDLIFE INFORMATION NETWORK: MOVING TOWARDS A GLOBAL DATASET FOR URBAN WILDLIFE.

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Urban wildlife research has the capacity to guide co-existence and future interactions between humans and wildlife in developed regions. Yet most urban wildlife research is limited to short-term, single-species studies typically conducted within a single city. This restricted focus prevents us from deriving global patterns and first principles regarding urban wildlife behavior and ecology. To overcome these limitations, we have designed a pioneering research network, the Urban Wildlife Information Network, where partners collaborate across multiple cities to collect long-term, systematic, multi-species data. Data collected via this network support analyses that will enable us to build basic theory related to urban wildlife ecology. We ultimately view the network as an applied tool, one whose data will connect the public to urban nature at a continental scale, and provide information critical to urban planners and landscape architects. Our network thus has the potential to advance knowledge and improve our ability to plan and manage cities to support biodiversity.

RETROFITTING ECOLOGY INTO THE URBAN ENVIRONMENT.

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The urban environment has historically been built without consideration for healthy ecosystems. Over time, we've learned more about our dependence on functioning ecosystems and we've realized that our historic development approach of eliminating ecological functions on project sites is detrimental for both humans and the environment. Fortunately, development practices are being implemented that turn traditional approaches upside down by utilizing stormwater and native vegetation as valuable resources rather than viewing them as problems. Current approaches including Green Infrastructure (GI) and Low Impact Development (LID) demonstrate that ecosystem services can successfully be integrated into urban areas, benefiting people and nature. Urban development projects offer opportunities to retrofit ecology back into these areas and provide water quality benefits, habitat connectivity, pollinator services, and conservation of native species biodiversity, among other benefits. These favorable outcomes can often occur along with recreational elements that further benefit human users. This presentation will highlight projects within urban areas along the San Antonio River that utilize GI and LID design principals to convert degraded sites including barren traditional commercial landscapes, concrete ditches and channelized drainage ways from lifeless landscape elements into attractive spaces where people like to spend time and nature is allowed to thrive.

CONSUMPTION OF FREE-ROAMING CATS BY COYOTES IN SOUTHERN CALIFORNIA.

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Coyotes (*Canis latrans*) are among the most successful carnivores in urban and suburban environments, which has increasingly led to conflicts between coyotes and people in southern California. One possible contributor to high coyote population densities and human-coyote encounters is the abundance of free-roaming domestic cats (*Felis catus*) subsidized by backyard feeding and trap-neuter-release (TNR) programs. To determine if coyotes are attracted to and regularly eat domestic cats, we identified prey items in stomachs of road-killed coyotes and coyotes purposely killed as nuisance animals. We hypothesized that consumption of free-roaming cats would be directly related to cat abundance, as measured by the density of TNR colonies and other landscape factors association with urbanization. To date we have processed 296 coyote stomachs, 213 (72%) of which contained animal prey and anthropogenic foods, and 162 (55%) of which contained mammalian prey that could be identified to at least the ordinal level. Of the latter, 60% preyed upon rodents, 27% ate rabbits, and only 8% ate wild mesocarnivores. Cat remains were found in 19% of these stomachs and 10% of all stomachs examined. We are currently mapping locations of TNR colonies to determine if coyotes that ate cats were collected near these locations and to identify landscape characteristics associated with consumption of cats and other anthropogenic foods, as well as the locations of TNR colonies. When completed, our results will improve understanding of the role of TNR colonies as a possible attractant to coyotes that increase human-coyote conflicts.

21st CENTURY TRAPPING FOR IMPROVED EFFICACY AND ETHICAL CONSIDERATIONS.

Quinton Martins, Audubon Canyon Ranch, quinton.martins@egret.org; Neil Martin, Keysight Technologies.

Monitoring the movement and behavior of cryptic species, particularly large carnivores, is reliant on the capture, handling and placement of tracking devices or markers on these animals. The advent of new technology such as affordable computer and electronic processors, GSM and satellite technology, has made innovative and safe capture of many animals more attainable. We have used this technology to redesign a double-door walk-through box trap used to capture and radio-collar leopards and caracal in South Africa (Martins 2010). Modifications included the automation and improved safety of the trap. We used ultrasonic range sensors installed at the top of the cage pointing downwards to detect the distance to the animal, so as to only trigger for select-sized animals or larger, thereby minimizing the chance of smaller by-catch. We added a 12-volt timer, to activate or deactivate the cage depending on the availability of the field personnel or conditions which could prove a threat to the welfare of the animal. We have been successful in trapping mountain lions using this technique, and show that automation limits non-target captures, improves efficacy while simultaneously minimizing trap management. In areas where the use of cable restraints or leghold traps are not allowed, and hounds or bait supply is challenging, this walk-through trap is an effective replacement for trapping mountain lions, and with minor adjustments, could be implemented for multiple species. We encourage

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more work to be done in the field of improving trap designs for animal welfare and scientific purposes.

***GRIFFITH PARK RAPTOR SURVEY: NEST RE-USE ACROSS SPECIES AND LESSONS LEARNED.**

Courtney McCammon, CJ Biomonitoring, courtneyjean2@gmail.com; Daniel S. Cooper, Cooper Ecological Monitoring.

Raptors are important apex predators in most of the earth's ecosystems, and coastal southern California supports (or once supported) around a dozen breeding species (Garrett and Dunn 1981). Beginning in 2017, the Griffith Park Raptor Survey represents the first specific, comprehensive dataset of an entire raptor community in the Los Angeles area. Over 50 active raptor nests were monitored including several species such as Red-tailed hawk, Red-shouldered hawk, Cooper's hawk, and Great Horned Owl. We found a 39% re-usage rate across all species in 2018 and that Red-tailed hawks maintain a higher-than-average rate (59%), meaning that more than half of Red-tailed hawk nests found the first survey were also active the following year. The lowest fidelity of the four species was found in Cooper's hawk (29% re-usage rate), meaning fewer than a third of Cooper's Hawks nests were re-used the following year. While the sample sizes were small, 2 of the 7 Great Horned Owl nests were re-used in 2018 (28%), and just 1 of the 4 Red-shouldered hawk nests were re-used in 2018 (25%). The finding that Red-tailed Hawk showed a much higher-than-average rate of re-use is not surprising, as this is the largest species, and it constructs the largest, most elaborate nests, and is well-known for re-using these nests. The lower rates of re-use found in the other species, in particular the Cooper's hawk, may either be an adaptation to varying conditions of "urban life", or it may indicate the opposite – a vulnerability to loss of nest sites.

SECURING REFUGE PATCHES FOR TIGERS IN A HUMAN-DOMINATED LANDSCAPE.

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Tiger dispersal assisted by unhindered movement within the landscape is imperative for tiger conservation and long term survival in the human-dominated landscapes of India. The Eastern Vidarbha Landscape in central India is chiefly characterized by heterogeneous land use patterns, outside inviolate habitats inside protected areas (PAs). Since habitat patches along movement corridors are patchy, it is essential to conserve them for long-term maintenance of habitat connectivity for tigers. We analyzed movement data from six collared tigers in ArcMET 10.2.2v3 and identified pockets in the landscape, outside PAs, where they were spending a considerable amount of time while dispersing or exploring. Potentially similar patches were identified across the landscape using a MaxEnt model of eco-geographical variables extracted from areas actually used by dispersing or exploring tigers as refuge. We identified 1587.88 sq km area of refuge patches across the landscape. Securing these parcels of land is of paramount

importance to aid tiger habitat connectivity in the study area, as it provides stepping stones in a fragmented human-dominated landscape. 60% of the identified potential refuge patches in the landscape falls in private or publicly owned lands and are outside the direct jurisdiction of the forest administration, requiring a higher quantum of work to secure these patches, necessitating a conservation approach involving multiple stake holders in the landscape.

SPECIES RICHNESS WITHIN AN URBAN COYOTE (*CANIS LATRANS*) TERRITORY IN ATLANTA, GEORGIA.

Christopher B. Mowry, Berry College, cmowry@berry.edu; Lawrence A. Wilson, Emory University.

Atlanta, Georgia has been one of the fastest growing metropolitan areas in the U.S. over the past several decades and the human population is now close to 6 million. Urbanization has been rapid and widespread, thereby creating a highly fragmented mosaic of urban green space. As metro Atlanta grew, so too did the region's Coyote population, which has caused a mix of curiosity, delight, and concern among the city's residents. Although the value of urban wildlife is now recognized by many people, the Coyote's role in the animal community is often misunderstood or unknown, particularly in areas like the southeastern U.S. where it is a relative newcomer. In an attempt to learn more about urban wildlife, particularly Coyotes, we monitored a suburban green space in Atlanta, Georgia using remote cameras for two years. A Coyote pair occupied the site throughout the duration of the study and they produced offspring during each year. Biodiversity was high, as we detected 14 different mammal, 2 reptile, and 18 bird species. Our study provides further insight into an urban Coyote population and its inclusion as part of an urban wildlife community.

EVALUATING SMALL MAMMAL HEALTH AND COMMUNITY COMPOSITION ACROSS THE CHICAGO METROPOLITAN AREA.

Matthew P. Mulligan, Davee Center for Endocrinology and Epidemiology and Urban Wildlife Institute, Lincoln Park Zoo, Chicago, IL, mmulligan@lpzoo.org; Maureen Murray, Davee Center for Endocrinology and Epidemiology and Urban Wildlife Institute, Lincoln Park Zoo; Mason Fidino, Urban Wildlife Institute, Lincoln Park Zoo; Michael J. Yabsley, College of Veterinary Medicine, University of Georgia, Athens, GA; Seth B. Magle, Urban Wildlife Institute, Lincoln Park Zoo; Rachel M. Santymire, Davee Center for Endocrinology and Epidemiology, Lincoln Park Zoo.

Small mammal ecology and health are often underexplored in urban environments despite their top-down influence on vegetation, importance as a prey species, and potential as disease vectors. Our study aims to understand small mammal population dynamics with urbanization. The research objectives are to: 1) determine small mammal presence/absence and relative abundance along an urban to exurban gradient in the Chicago metropolitan area, 2) examine population size and community composition of small mammals over time, and 3) measure the presence of Lyme disease (*Borrelia burgdorferi*) along an urban to exurban gradient. Live-trapping occurred from 2017-2018 with 893 unique individuals captured. Meadow voles (*Microtus pennsylvanicus*) and deer mice (*Peromyscus maniculatus*) represented 81% and 90% of individuals captured, respectively. Meadow vole populations declined in exurban sites from 2017 (68.9%) to 2018 (50.9%) with deer mice showing the opposite trend (2017=13.3%, 2018=40.7%).

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However, vole and deer mouse abundance were quite similar in urban regions across years, albeit at lower overall numbers. Species richness did not vary ($p > 0.05$) between regions, but was typically driven by one or two species-rich sites. Furthermore, estimated median survival probability for deer mice and meadow voles were higher in regions transitioning between urban and exurban. Ticks gathered from small mammals in 2017 ($n=54$) and 2018 ($n=132$) resulted in 19% of the *Ixodes scapularis* testing positive for Lyme disease in 2017 at all site types, but only 2% in 2018. Understanding small mammal composition and disease across urban landscapes can lead to more resilient wildlife communities while influencing human health.

NOT THE USUAL SUSPECTS - HOW TO RAISE \$4 MILLION FOR RESTORATION.

Carol Murdock, Clean Water Services, Hillsboro, OR, murdockc@cleanwaterservices.org.

What do computer processors, onion farming, solar radiation, urban development, and birds have in common? Come find out how to expand the potential pool of funding sources for restoration by expanding your thinking and following the threads that connect ecology to economy and community. The Tualatin Basin lies just west of the Portland, Oregon metropolitan area. The 800 acre Wapato Lake National Wildlife Refuge lies near the top of the basin and has a long sordid history of impacting the downstream communities of Washington County. Over the past ten years, events at Wapato Lake have highlighted an important connection between the ecology of the Wapato lakebed, unprecedented investments in economic development in the County, and the needs of an ever growing urban population. This connection has spurred a unique group of community-based organizations to seek to identify the common threads that align the goals of each of their organizations and leverage resources to address environmental problems that affect them all. A ten-year investment in building these relationships has resulted in the combined contribution of almost \$4 million dollars in restoration funding across the basin in last two years alone. This collaborative partnership has so far raised \$2.5 million for the restoration of Wapato Lake and are now poised to begin construction on the first phase of the restoration project in the summer of 2019.

CITY SICKER? THE RELATIONSHIP BETWEEN URBANIZATION AND WILDLIFE HEALTH.

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Medicine, University of Minnesota.

Urbanization results in changes in resource availability, land use, and community composition, which can in turn influence wildlife health. To quantify the impacts of cities on wildlife health, we performed a phylogenetic meta-analysis of 515 records spanning 95 wildlife species from 106 studies and compared the toxicant loads, parasitism, body condition, or stress of urban and non-urban wildlife populations in 30 countries. We find a significantly negative relationship between urbanization and wildlife health. Specifically, urban wildlife had higher toxicant loads and greater prevalence of parasites that are transmitted through close contact among hosts. Invertebrates and amphibians were particularly affected, with higher toxicant loads and physiological stress in urban populations as compared to their non-urban counterparts. Our results suggest that urban wildlife experience several health risks with potential threats to conservation.

HOW HEALTHY ARE CITY RATS? UNDERSTANDING PATHOGEN PREVALENCE, STRESS, AND RODENTICIDE POISONING ACROSS DIVERSE CHICAGO NEIGHBORHOODS.

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Brown rats (*Rattus norvegicus*) are one of the most successful urban exploiters in cities around the world. Rats also pose serious public health risks because they can carry many diseases shared with humans, known collectively as rat-associated zoonoses. Within cities, rats are typically more abundant in lower-income areas, which may also promote zoonotic infection risk. We studied rats in Chicago, where rat complaints are the highest in the United States, and collaborated with a pest management company to trap rats in 12 neighborhoods along an income gradient. We measured the prevalence of *Leptospira interrogans* (the causative agent of leptospirosis), *Salmonella* spp. and *Escherichia coli* and recorded individual characteristics of rats that may promote susceptibility to infection such as age and sex class, body condition, chronic stress, and signs of rodenticide poisoning such as hemorrhaging and blue staining. We analyzed 212 rats trapped in spring and fall 2018. The prevalence of *Leptospira* was low overall (7%) but ranged up to 17% of rats in individual neighborhoods. The prevalence of *E. coli* was much higher (39%) and was significantly higher among female rats ($\beta = 1.3 \pm 0.76$, $p = 0.04$) and rats with visible signs of rodenticide poisoning ($\beta = 1.30 \pm 0.54$, $p = 0.03$). Our results suggest that exposure to rodenticides may increase disease susceptibility in rats and that infection risk varies significantly across urban neighborhoods.

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BIRDS, VACANT LOTS, AND ENVIRONMENTAL JUSTICES.

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Vacant residential lots are a prominent feature of many cities. Recent research has emphasized the ecosystem services associated with the lots, and conservation agencies and local governments have looked to these sites as places that can be managed for wildlife and people. However, residents living near vacant lots often experience their negative aspects of these sites: weedy trash field sites; presence of species that are vectors for disease; and increased exposure to crime. In this presentation I will use examples from Baltimore and St. Louis to illustrate how using an environmental justice framework to address birds, bird habitat and urban residents may be a useful approach to conservation issues around vacant lots.

THE URBIONET RESEARCH COORDINATION NETWORK: NEW PERSPECTIVES ON THEORY AND PRACTICE OF URBAN BIODIVERSITY.

Charles Nilon, University of Missouri, nilonc@missouri.edu; Myla Aronson, Rutgers University; Chris Lepczyk, Auburn University; Tommy Parker, Shorter University; Paige Warren, University of Massachusetts-Amherst.

In March 2014 we received funding from the US National Science Foundation to develop a Research Coordination Network (RCN) focusing on urban biodiversity research and practice. The Urban Biodiversity Research Coordination Network has six primary goals: 1) to expand a global urban biodiversity database by incorporating data from cities in Africa, South America, and South Asia; 2) to engage scientists and managers globally to compile and synthesize datasets on taxonomic groups in cities with an initial focus on bats, birds, freshwater fish, insect pollinators, and plants; 3) to identify generalities on the patterns and processes shaping urban biodiversity across the world's cities; 4) to quantify the relative importance of physical, climatic, and social factors in driving patterns of urban biodiversity; and 5) to develop recommendations for monitoring biodiversity in urban areas. In this presentation we will review the activities of the three UrBioNET working groups, discuss the crosstown walk project, and give an overview of the existing data and products that are available through the network and future network activities that will engage researchers and practitioners.

DINOSAURS IN DOWNTOWN: ALLIGATOR SNAPPING TURTLES THRIVE IN HOUSTON'S BAYOUS.

Kelly Norrid, Texas Parks and Wildlife, kelly.norrid@tpwd.texas.gov.

Unbeknownst to the majority of the 2.3 million residence of the 4th largest city in the U.S., there are healthy populations of alligator snapping turtles living in the murky waters of the Bayou City. One of the largest known urban populations of *Macrochelys temminckii* occupy the bayous that are literally in the shadows of the skyscrapers of downtown Houston, Texas. There are currently two studies underway in two major bayou systems in the City of Houston, to better

understand the habits and habitat of this dinosaur of the turtle world. In collaboration with the Turtle Survival Alliance, turtles in Buffalo Bayou are being tagged with radio transmitters to track their movement along the bayou system that runs through downtown. A second study is currently underway to establish their presence or absence in Greens Bayou, a nearby waterway that meanders through natural, residential, recreational and industrial areas of east Houston. Once their presence or absence is determined in Greens Bayou, additional sections of the bayou with varying levels of development will be surveyed to evaluate whether development intensity of the bayou affects the fitness of alligator snapping turtle populations. The results will be used to influence urban policy of development and management of these important riparian ecosystems.

NHMLA BACKYARD BAT SURVEY: NEW STRATEGIES IN URBAN BAT RESEARCH AND OUTREACH.

Miguel Ordeñana, Natural History Museum of Los Angeles County, mordenan@nhm.org; Ted Weller, U.S. Forest Service; Enjie Li, Natural History Museum of Los Angeles County/Nature Conservancy.

Previous bat studies in Southern California have focused on large urban parks, so there is a scarcity of data on how bats use the core of urban habitat such as residential areas. Backyards and private property comprising the bulk of urban areas are typically inaccessible to researchers, therefore previous studies have been limited in scale to secure public spaces. The Natural History Museum of Los Angeles County (NHMLA) aims to overcome this limitation by working with homeowners to incorporate bat acoustic monitoring into a preexisting multi-disciplinary biodiversity survey called the SuperProject. The SuperProject is a multi-year citizen science backyard survey of various taxonomic groups and environmental data along multiple habitat gradients. A backyard bat survey was incorporated into the SuperProject to measure the impacts of environmental variables such as foraging availability and proximity to the urban edge on bat species richness and activity in backyards. Bat detectors were deployed in 26 SuperProject backyards throughout L.A. County between 2016 and 2017, for one month each. Twelve species were detected, which included five species listed as vulnerable and species of special concern by the state of California. In late 2018, 20 bat detectors were deployed in southern Los Angeles backyards simultaneously for an entire year, in an effort to illuminate seasonal patterns in bat activity. The results of the study will inform city residents and planners how to provide suitable habitat for bats in urbanized and urbanizing landscapes as well as engage local community members in urban bat research and conservation.

MEASURES OF FITNESS IN AVIAN POPULATIONS AS A MEASURE OF ONE HEALTH.

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One Health provides a platform to conceptualize the close interactions and interdependence of human and ecosystem health. Stressors, both environmental and disease are critical

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factors in maintaining optimal One Health of both. Birds provide unique clades of organisms that reflect both regional and global health, particularly the migratory populations. The focus of this presentation will be considering response of birds, at individual and population levels to anthropogenic stressors, associated with industry and urbanization pressures as well as the impacts of hurricanes and other naturally occurring events. Metrics of health will be considered as key indices for ascertaining the health of avian populations; these metrics will be considered in the context of Adverse Outcomes Pathways. We will also consider the availability of retrospective data to ascertain changes over long time periods and for development of a predictive tool for managers. Coastal habitats along the Gulf of Mexico coast will be our primary focus for long-term datasets in avian populations; we will also evaluate the availability of other long-term datasets for avian populations from a global view.

CONNECTING WILDLIFE IN URBANIZED LOS ANGELES.

Constanza Pallini-Tipton, City of Los Angeles, conni.pallini-tipton@lacity.org.

When people think of wildlife in Los Angeles they don't necessarily imagine pumas, egrets, or deer. But Los Angeles is part of the Southern California Floristic Province, a hub of biodiversity in Southern California. The City is exploring regulations for new development in the Santa Monica Mountains areas more renowned for wild parties and hillside mansions with panoramic views than sensitive habitats and special plant and animal species. The City is in the early stages of identifying new regulations for urban development that balance wildlife protection goals with private ownership rights.

***MOVEMENT ECOLOGY AND GENETIC CONNECTIVITY OF THE ENDEMIC SWAMP DEER ACROSS FRAGMENTED, HUMAN-DOMINATED GANGETIC PLAINS OF THE NORTHERN INDIAN SUBCONTINENT.**

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The Northern swamp deer *Rucervus duvaucelii duvaucelii* (IUCN-Vulnerable) is the largest grassland-dwelling endemic cervid of the human-dominated Gangetic plains. With a global population of less than 3000 individuals, they are distributed across fragmented grassland patches in north India and southern Nepal. We surveyed the entire stretch of Ganges river between Jhilmil Jheel Conservation Reserve (JJCR) and Hastinapur Wildlife Sanctuary (HWLS) to ascertain fine-scale swamp deer distribution. We looked for swamp deer signs, collected biological samples and identified suitable habitats and threats across the entire human-dominated landscape. Further, using radio-telemetry, camera trapping and genetic analyses we investigated movement pattern and genetic connectivity among these grassland patches. We found much fine-scale swamp deer distribution than earlier known and identified a new population. Our assessments indicate habitat encroachment, infrastructural developments,

hunting and habitat conversions as major threats for swamp deer. We genetically identified 192 unique individuals from two genetic lineages between JJCR and HWLS. Subsequent analyses indicated an intermixing population with low inbreeding coefficient ($F_{is} = 0.039$). Information from two females radio-collared in JJCR suggested movement towards HWLS and extensive use of fragmented, human-dominated grasslands. Further camera-trapping revealed temporal segregation between human-swamp deer and indicated that these habitats are critical fawning and breeding grounds. Amidst burgeoning human interventions, these critical remnant grassland patches between the two protected areas continue to play a pivotal role in maintaining viable swamp deer population in this landscape. These urban grassland patches along Ganges require immediate attention to safeguard swamp deer and other threatened fauna inhabiting these grasslands.

WHERE LAWN MAY AS WELL BE LAVA: THE LOW HABITAT VALUE OF LAWN FOR HERPETOFAUNA INHABITING URBAN PARKLANDS IN LOS ANGELES.

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Urban parklands are typically managed for multiple uses, and as a result often consist of diverse types of habitat including areas dominated by hardscape, lawn, and more natural vegetation. Here, we assess habitat usage by multiple species of native lizards and snakes in two different urban parklands in the Los Angeles area. Focal sites include a state recreation area in the Baldwin Hills of western Los Angeles and a 4-km stretch of the soft-bottomed portion of the Los Angeles River in central Los Angeles that includes several pocket parks. Both areas are surrounded by heavily urbanized residential and commercial neighborhoods. Through field surveys, we made 2740 observations of lizards and snakes in the Baldwin Hills and 729 observations along the L.A. River, and these were bolstered by additional photo-vouchered records generated by citizen scientists. Spatial analyses of these records revealed that lawn, asphalt, and flat concrete areas are all hardly used by lizards and snakes. While lizards and snakes were frequently observed in shrub areas adjacent to lawn or hardscape, they were almost never seen using lawn or flat hardscape. Instead, animals were found predominately in areas with leaf litter, shrubs, and/or woody vegetation, including in areas recently planted as part of restoration efforts. These results show that at least in Southern California, lawn provides minimal habitat value for native lizards and snakes. Thus, efforts to increase habitat for herpetofauna should focus on converting lawn and hardscape into areas with more natural vegetation.

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EVALUATING RELATIONSHIPS BETWEEN BATS AND URBAN LANDSCAPES.

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Bats in North America are under grave threat by White Nose Syndrome (WNS), caused by the fungus *Pseudogymnoascus destructans* (Pd). Pd has decimated populations in New York starting in 2006 and has radiated across the United States and Canada (Blehrt et al. 2009). Pd physically irritates the bats during hibernation, resulting in abnormal behavioral changes (Brownlee-Bouboulis and Reeder 2013), premature usage of stored energy, dehydration, and finally death. Since Pd requires cold and humid environments to survive, urbanization's "heat island effect" may alter Pd's impact on bat populations. The "heat island effect" results from urbanization's impervious surfaces and manmade structures creating warmer and drier climates. These structures, planted trees, artificial lights, and additional water sources may inadvertently offer bats roosting, commuting, and foraging habitat. Therefore, I hypothesize that, with the appropriate combination of landscape features, urban areas within a WNS--positive region could serve as habitat for WNS-sensitive bats. To test this overarching hypothesis, I deployed bat acoustic detectors, insect traps, light loggers, and sound meters every week from March through October from 2015-2017 among three urbanization levels (High, Medium, and Low) in Mid-Atlantic States. Almost 300,000 echolocation calls were recorded over 1,200 nights. There were significantly more total bat calls in highly urbanized sites. Preliminary GLMM models will be presented to indicate which habitat features were important for each species and at each urbanization level. Echolocation calls were converted to presence/absence so occupancy modeling can be run in PRESENCE.

HOTSPOTS AND BLINDSPOTS: HOW COMMUNITY SCIENCE CAN PERPETUATE ENVIRONMENTAL INJUSTICE.

Deja Perkins, College of Natural Resources, North Carolina State University; Madhushan Katti, College of Natural Resources, North Carolina State University.

Urban green spaces like parks and gardens are known to offer positive impacts on physical and mental health. There are racial and socioeconomic discrepancies, however, in access to quality and diversity of urban green spaces. Access to high quality green spaces is important for both human health and wellbeing and for urban wildlife. Urban green spaces are habitat patches offering food, movement, and breeding sites to many species. Members of the public can play an important role documenting the distribution and diversity of wildlife via a variety of citizen science projects, such as the popular eBird platform. A big caveat of eBird data are potential reporting biases of volunteers, which may not be representative of the urban landscape or demographics. We compare data from two systematic citizen science projects, the Fresno Bird Count (FBC) and the Tucson Bird Count (TBC), with contemporaneous data from eBird, to investigate differences in spatial resolution and estimates of bird distribution and diversity in relation to underlying socioeconomic gradients. The systematic approach uses standardized point counts at locations distributed across the entire urban habitat matrix, in

long-running projects in Tucson, AZ (since 2001) and Fresno, CA (since 2008). We demonstrate that systematic point counts provide a more accurate representation of bird diversity and distribution across the urban matrix than eBird. Our analysis reveals both hotspots of eBird reporting and blind spots in coverage of lower income and racially diverse neighborhoods, highlighting how citizen science platforms can inadvertently perpetuate environmental injustice in cities.

CONNECTING CITIES AND BIODIVERSITY RESOURCES THROUGH THE URBAN BIODIVERSITY HUB.

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Urban biodiversity is increasingly recognized as a crucial front for both nature conservation and human wellbeing. However, the sheer scope and number of initiatives and projects relevant to urban biodiversity and its effects on human society is staggering, encompassing nature-based solutions, green infrastructure, habitat restoration, environmental education, citizen / community science, and much more. A core mission of the Urban Biodiversity Hub is to gather and analyze global data on urban biodiversity activities, now available in a publicly searchable online database (<http://www.ubhub.org>) for use and analysis. This georeferenced data is available via a searchable map that can be filtered by variables such as city size, and it currently includes activities from more than 1,200 locations worldwide. This frequently updated map and database make it easier to see the extent of urban biodiversity activities that have been undertaken so far. Each of the Urban Biodiversity Hub map's markers contains a list of urban biodiversity activities, documents, programs (such as the Singapore Index, Ecological Footprint, or Mayor's Monarch Pledge), and awards related to that location, along with links to original sources and documents. Data may be searched by keyword and filtered by urban biodiversity program participation, government level, population size and density, conservation status, ecological biome, and more. By consolidating these data, we hope to not only facilitate learning from the experiences of other locales, but to aid in big-picture analysis that may reveal patterns and best practices and support regional, national, and even international partnerships between municipalities and other actors.

RED FOXES AND COYOTES IN AN URBAN LANDSCAPE: PREVALENCE AND RISK FACTORS FOR DISEASE.

Meghan Pluemer, University of Wisconsin-Stevens Point, pluemer.meghan@gmail.com; Shelli Dubay, University of Wisconsin-Stevens Point; David Drake, University of Wisconsin-Madison; Shawn Crimmins, University of Wisconsin-Stevens Point; Tessa Veverka, University of Wisconsin-Stevens Point; Miranda Torkelson, University of Wisconsin-Madison; Holly Hovanec, University of Wisconsin-Madison; Marcus Mueller, University of Wisconsin-Madison.

Urbanized landscapes are increasing, posing novel disease risks for humans, their domestic pets, and urban wildlife. Urbanized areas contain fragmented landscapes and abundant resources, resulting in concentrated and increased wildlife populations in relatively close contact with other wildlife species, humans, and their domestic pets, thereby facilitating inter-

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specific disease transmission. We trapped and radio-collared fifteen red foxes (*Vulpes vulpes*) and fourteen coyotes (*Canis latrans*) in the urban landscape of Madison, Wisconsin, to determine the prevalence of disease among these canids and to examine how these canids were using the landscape. Using Fisher Exact Probability Tests, we found that coyotes had a significantly higher prevalence of Lyme disease (p-value=0.002) and canine heartworm (p-value=0.02) than foxes. Although the difference was not significant between the two species (p-value=0.45), exposure to canine parvovirus was greater in foxes than in coyotes. Understanding the prevalence of disease in urban canid populations is important because diseases that affect urban canids cause morbidity and mortality and are transmissible to domestic dogs, and vice versa. Additionally, urban canids may serve as sentinels for zoonotic diseases such as Lyme disease and Leptospirosis.

CONNECTING PEOPLE TO CONNECTIVITY: FROM CELEBRITY CATS TO ECO-HIP HOP.

Beth Pratt, National Wildlife Federation, prattb@nwf.org.

Wildlife needs connectivity just like we do, and people need connections to wildlife. This session explores the National Wildlife Federation's Connecting Los Angeles program, a multi-layered project that seeks to transform human infrastructure into greenspace to create linked corridors for the betterment of both wildlife and people. This replicable project has a very specific and traditional conservation outcome—increasing greenspace and biodiversity in an urban area—but utilizes non-traditional approaches to achieving those outcomes in order to create a welcoming and inclusive community that celebrates diverse perspectives about the natural world. At the core of this effort is NWF's long established Certified Wildlife Habitat and EcoSchools programs, which are used as the connecting driver to influence the change, using them as anchors to expand wildlife habitat connectivity and community engagement across the city. Since 1973, these programs have been educating and empowering people to turn their own small pieces of Earth in their cities, towns, and neighborhoods into wildlife friendly spaces. To date over 217,000 people have enrolled in the program, which has transformed more than 2.5 million acres into wildlife habitat across the country. To compel people to take action, and join the city-wide corridor envisioned of CWH/EcoSchools, the project outreach recognizes there is no one, right, correct way to connect to nature. The session will show examples of innovative methods to connect people to connectivity, such as the annual P-22 Day Festival and Urban Wildlife Week, a VR film, hip-hop music, and many more.

THE POWER OF PARTNERSHIPS: BUILDING THE LARGEST WILDLIFE CROSSING IN THE WORLD.

Beth Pratt, National Wildlife Federation, prattb@nwf.org.

How do you get the largest wildlife crossing in the world built, under a rapid timeline, and with a price tag of over \$60 million? The old adage "It takes a village," proves once again true, as the wildlife crossing at Liberty Canyon project illustrates the vast power of partnerships. In

this session, learn how a focus on core partnerships and leveraging widespread public support has taken this wildlife crossing from a visionary idea to an impending reality. The strength of the wildlife crossing project from its earliest stages has been a dedicated coalition built with a wide variety of public, private and nonprofit resources, agencies, and supporters. The Liberty Canyon Wildlife Corridor Partnership is at the core of this effort, and is represented by: California Department of Transportation, National Park Service, Santa Monica Mountains Conservancy/ Mountains Recreation and Conservation Authority, National Wildlife Federation, and the Resource Conservation District of the Santa Monica Mountains. In this session, you'll learn the key roles each of the partners play in this project, from research, design, land management, advocacy, education and fundraising, and also get an update on the project, which has entered the final design and engineering phase. Additionally, we'll explore what is possible in leveraging public support for a project on public lands with showing examples of how the initiative is using a variety of contemporary techniques, including social media marketing, a "celebrity" mountain lion personality, crowd-sourcing, and foundational and private sector funding.

A NEW COMPETITOR IN THE URBAN RAT RACE.

Brandy Pyzyna, SenesTech, Inc., Brandy.Pyzyna@senestech.com; Clay Mansfield, Courtney Ray, Emily Yurcich, Cheryl Dyer, Loretta Mayer, SenesTech, Inc.

Management of commensal rodents in urban environments presents a unique challenge, as both Norway and Roof rats take advantage of nearly unlimited food, water, and shelter provided by humans. Traditional management techniques, such as lethal rodenticides, do not control rodent populations long-term due to increasing resistance to anticoagulant compounds, and population rebounds. Additionally, a safer alternative to poisons in urban centers is desired, as there are zoos, companion animals, and birds of prey. The prolific reproductive ability of *Rattus* spp. allows them to breed their way out of trouble in response to almost any human-implemented control measure. Sustainable rodent population management requires a new approach targeting the biological source of overabundance: reproduction. Fertility control in the form of contraceptive bait is emerging as a safe, non-lethal and effective method of long-term population management. SenesTech, Inc. (Flagstaff, AZ) has developed ContraPest®, a fatty, sweet, and palatable liquid bait that when used as part of a targeted baiting strategy, in which rats have continuous bait access, is an effective method of fertility management. The product is metabolized in less than 15 minutes which minimizes the threat of secondary species exposure. Bait shyness is reduced, as it does not kill or cause illness. Long-term use of poisons has resulted in resistance to certain compounds, while Shuster et al (2018) show that contraception will not favor evolution to resistance. With our expanding experience among users it is becoming clear that fertility control represents a new solution to a centuries-old problem within our cities.

***EXOTIC MAMMALS IN URBAN REGIONS: A SPATIALLY-EXPLICIT INSIGHT INTO PEST CONTROL AND BIODIVERSITY CONSERVATION IN CHRISTCHURCH, NEW ZEALAND.**

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Research shows most New Zealand cities have been established at ecosystem junctions and

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there exists a widespread conflict of requirements between exotic and native wildlife in these regions. This study was conducted to map challenges and opportunities for urban wildlife management from a spatial perspective in Christchurch New Zealand (43.53° S, 172.63° E; population ca. 367,000). The dispersal patterns of three exotic mammalian species (i.e. stoat, common brushtail possum, red deer) were studied in relation to the extent of land cover classes. This was done by performing a multi-stage overlay analysis of various datasets including (1) Land Cover Data Base v.4.1, (2) Distribution of Stoats 2002-2014, (3) Distribution of Possums 2002-2014, and (4) Distribution of Red Deer 2002-2014 in the Arc GIS environment. Results show ca. 100%, 98.4%, and 14.8% of the study area are subject to the presence of stoat, common brushtail possum, and red deer, respectively. A hotspot was detected at the southern part of the city, where these mammals coexist. Areas covered by the class Indigenous Forest, which provide the main habitat and food sources for native wildlife species in New Zealand, are completely confined to this hotspot. This finding has at least 5 important implications for pest control and biodiversity conservation in urban New Zealand and probably similar cases in other countries.

WILD IN SEATTLE: USING CITIZEN SCIENCE, HIGH-TECH REPORTING TOOLS, AND COMMUNITY ENGAGEMENT TO INCREASE HUMAN-WILDLIFE COEXISTENCE IN THE GREATER SEATTLE AREA.

Katie Remine, Woodland Park Zoo, katie.remine@zoo.org; Robert Long, Woodland Park Zoo; Mark Jordan, College of Science and Engineering, Seattle University, jordanma@seattleu.edu.

The Seattle metropolitan area is one of the fastest growing urban areas in the United States, yet exists within a short distance of a native forest that hosts an intact native carnivore community. Further, species including coyotes and bobcats are becoming more common in both suburban, and even urban, areas in this region. Through a collaborative effort between Woodland Park Zoo and Seattle University, we have engaged students – from middle school through university undergraduates – as well community members in programs that advance scientific knowledge about carnivores in their communities while developing community-driven solutions for peaceful coexistence. Through hands-on camera trapping, and targeted science inquiry skill-building, we are improving attitudes toward local carnivores and developing a greater awareness of actions community members can take to reduce conflict. Further, we are developing web-based tools to enhance community engagement in research that links human communities to the animal communities living around them.

INVESTIGATION OF A FRESHWATER TURTLE MORTALITY EVENT IN FORT WORTH, TEXAS.

Rachel Richter, Texas Parks and Wildlife Department, rachel.richter@tpwd.texas.gov.

In late 2018, reports of numerous dead turtles at a neighborhood lake in Fort Worth, Texas prompted an investigation. Turtles at the site exhibited extreme lethargy, swollen eyes, and difficulty submerging. Four different species at the site were impacted including *Trachemys scripta elegans*, *Pseudemys concinna*, *Apalone spinifera*, and *Chelydra serpentina*. Preliminary

necropsy results were unable to isolate a virus and suggested a potential bacterial, fungal or parasitic cause. This presentation will discuss the investigation into the cause of this mortality event, the impact to the turtle population, and the historical and current management practices in place at the site.

FEMALE BOBCAT SOCIAL ORGANIZATION IN A FRAGMENTED URBAN LANDSCAPE: HIGH OVERLAP FOR CLOSE RELATIVES.

Seth Riley, NPS-Santa Monica Mountains National Recreation Area, seth_riley@nps.gov; Joanne Moriarty, NPS-Santa Monica Mountains National Recreation Area; Shaelynn Sleater-Squires, Laurel Serieys, UCLA Department of Ecology and Evolutionary Biology.

Urbanization and the resulting habitat loss and fragmentation can have profound effects on wildlife behavior and ecology, especially for wide-ranging species such as carnivores. Through our long-term study at Santa Monica Mountains National Recreation Area northwest of Los Angeles we have seen that home range size, movements, survival, diet, toxicant exposure, disease prevalence, and even gene flow have been affected by human development, including roads. Here we evaluate social relationships from 1996-2006 for female bobcats, the sex that is particularly important for population persistence since they provide all of the parental care. Previous studies of bobcat social organization have found that females are strongly territorial, and that there is generally low home range overlap between neighboring females and none between core areas. We found multiple cases of very high overlap between females, for overall home ranges and even for core areas. We also genotyped all bobcats at 21 highly variable microsatellite loci to evaluate genetic relatedness, and our intensive work on bobcat reproduction provided a valuable verification of relationships estimated by genotyping. Every pair of female bobcats with a high degree of overlap was also closely related with a relatedness coefficient of at least 0.25, the level of half siblings or first cousins, and generally closer to 0.50, the level of parent-offspring or siblings. The small home ranges, very high overlap, and resulting high population density in this highly fragmented landscape may be facilitated by a willingness to tolerate close relatives.

SPATIAL ANALYSIS OF WHITE-TAILED DEER (ODOCOILEUS VIRGINIANUS) MOVEMENTS IN CONJUNCTION WITH INTEGRATED PEST MANAGEMENT TREATMENTS IN A SUBURBAN LANDSCAPE.

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Regions of the United States continue to experience an increase in zoonotic diseases, most notably tick-borne diseases such as Lyme. White-tailed deer (*Odocoileus virginianus*) are a keystone host for adult ticks. Deer may have the most influence on maintaining tick populations and implicated the emergence of several zoonotic tick-borne diseases. Concurrently urbanization and habitat fragmentation has elicited a dramatic increase in white-tailed deer.

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This change in land use has facilitated deer population explosions and may have caused an increase in tick populations and other deer-human conflict. The current study is part of an USDA-supported Integrated Tick Management (ITM) project testing the efficacy of host-targeted 4-poster feeders in combination with other IPM treatments. This information could lead to better strategies to reduce the risk of Lyme to people and animals on public and private land. As such, the study objectives are to: 1) evaluate spatial and temporal movement patterns of white-tailed deer in a suburban landscape; 2) determine best location and timing of placement for '4-Posters'; 3) determine impact of deer management on deer activity to help county officials better plan deer management (managed hunts, sharpshooting, IPM treatments). A total of 48 white-tail deer were trapped and collared in five county parks during the winter of 2017 and 2018 using drop nets and clover traps. Fifteen bucks and 33 doe were fitted with GPS radio collars. Collars will begin to drop off in Spring 2019. The '4-Poster' tick treatment stations have been deployed at four parks and will be maintained every two weeks. Once recovered, GPS and activity data will be analyzed in ArcGIS to determine relationships between spatial data attributes (sex, age, date, time) and landscape features (habitat types, fragmentation, urbanization, '4-Poster' devices).

MANAGEMENT OF URBAN BLACK-TAILED PRAIRIE DOG POPULATIONS USING NON-LETHAL REPRODUCTIVE CONTROL.

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Animal populations co-existing with urban human populations raise many issues, including conservation, public health, impacts upon habitats and property, and people connecting with nature. Black-tailed prairie dogs are a 'keystone species' for ecological health in the western US, but colonies can expand and over-graze, causing concerns for local land-owners. Lethal control is difficult, can be distressing to local stake-holders, and may not be effective if populations rebound rapidly or reinvade. We investigated the potential of an immunocontraceptive – GonaCon – to humanely and sustainably manage prairie dog populations by reducing breeding success. We used three matched pairs of sites – one site where we vaccinated adult female prairie dogs with GonaCon, and one site where we administered a sham vaccine – in Fort Collins and Denver, Colorado. Prairie dogs were captured for 3-4 days to enable mark-recapture population estimates. Reproductive output (number of offspring emerging from adult female's burrows) will be measured in spring 2019, and compared across treatments.

URBAN DEER POPULATION MANAGEMENT WITH PZP: STATE OF THE ART.

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Conflicts with thriving deer populations have persisted in urban and suburban communities for four decades. Mitigation measures, including changes in human behavior, can and should be pursued as part of a comprehensive plan to solve these conflicts. Often, however, communities demand that solutions include deer population management. Deer population management through public hunting is often unsafe, impractical, illegal, ineffective, or publicly unacceptable in cities and suburbs. Other lethal techniques such as sharpshooting have shown mixed success. Remotely-delivered immunocontraceptive vaccines such as porcine zona pellucida (PZP) offer a possible alternative deer population management tool that could be more suitable for cities and suburbs than existing alternatives. Field studies of PZP at Fire Island National Seashore, NY, Fripp Island, SC, and elsewhere have demonstrated that remotely delivered PZP can sharply reduce fawning rates among treated females; that single treatments of controlled-release PZP vaccines can yield two or more years of contraceptive effectiveness; and that deer populations in geographically isolated environments can be significantly reduced via contraception. An ongoing study at Hastings-on-Hudson, NY, has confirmed the long-term efficacy of the controlled-release vaccine and shown that boosters last at least two additional years. Because deer move freely across three of the four village boundaries, the study will also evaluate whether PZP administration can reduce deer populations in jurisdictions that are not islands; early results are encouraging. Host communities have been heavily engaged in all deer PZP projects, providing important avenues of public education about wildlife.

AN OVERVIEW OF THE WILDLIFE OF INDIANAPOLIS, IN (USA) ALONG THE URBAN TO RURAL GRADIENT.

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In order for policy-makers to make informed decisions regarding the management of urban habitats for wildlife, it is first necessary to know what species are present, where, and with what frequency. We used baited motion-sensitive cameras (camera traps) to document wildlife in Indianapolis, IN, a mid-sized North American city with a population of more than 860,000 (and more than 2,000,000 in the metro area). We identified 24 sites along two 35 km long transects from the urban core to outlying rural areas; sites consisted primarily of parks, cemeteries, golf courses, and remnant forests. We deployed a camera trap at each site for at least 28 consecutive days in January, April, July, and October 2017. The camera traps collected more than 74,000 images across the year, an average of 13.8 images/trap/day. Among the most common species recorded were raccoon (*Procyon lotor*), fox squirrel (*Sciurus niger*), opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), and cottontail rabbits (*Sylvilagus floridanus*). Coyote (*Canis latrans*) and red fox (*Vulpes vulpes*) were also fairly common in both the urban core and outlying rural areas. We present occupancy modeling for some of the common species in this, the first systemic survey of urban wildlife in Indianapolis.

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CATS SAFE AT HOME: AN INNOVATIVE PROGRAM FOR PROTECTING BIRDS AND CATS IN PORTLAND, OREGON.

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For more than two decades, the Audubon Society of Portland and the Feral Cat Coalition of Oregon have worked in partnership to humanely reduce the number of free-roaming cats and protect wild birds from cat predation in the Portland Metro Region. This highly creative and effective effort is considered unique in the United States on an issue that has consistently been marked by highly acrimonious and unproductive debates between bird advocates and cat advocates. The Audubon-Feral Cat Coalition Partnership has allowed Portland to develop and implement a series of effective strategies predicated on the goal of protecting both wild birds and cats. The "Cats Safe at Home Campaign" includes innovative outreach and engagement strategies, multifaceted approaches including Trap, Neuter and Return (TNR) to reduce the number of free-roaming cats, a nationally lauded "Catio Tour," community science, and a policy agenda. Attendees of this session will learn about the different elements of the Cats Safe at Home Campaign, the underlying principles that have allowed this collaboration to be successful and sustainable, and strategies to address cat overpopulation that are both humane and ecologically responsible. Audubon Society of Portland was founded in 1902 and is the largest chapter of National Audubon Society with over 17,000 members in the Portland Metro Region. Feral Cat Coalition of Oregon was founded in 1995 and has provided no-cost spay and neuter services for over 94,000 stray and feral cats.

INDICATOR COMMUNITIES FOR SONGBIRD CONSERVATION IN HETEROGENEOUS URBAN LANDSCAPES.

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Cities present opportunities for songbird conservation given the number of species they support and benefits birds offer urban humans. Given high heterogeneity in urban bird species distributions, habitat requirements, and urban landscapes, urban conservation requires different management strategies in different urban settings. This study proposed and demonstrated an approach for identifying environment-specific bird indicator communities and for using relationships between these communities and urban environmental characteristics to target management to particular settings. We demonstrated this approach in Iowa City-Cedar Rapids, Iowa, USA using field-surveyed, songbird abundance data. To characterize different urban settings in the study area, we classified survey sites into a series of urban-environment classes using k-means clustering and land-cover and tree canopy data. We identified songbird indicator communities, groups of species strongly associated with each environment class, using indicator species analysis and identified relationships between indicator communities and environmental attributes using binomial N-mixture models. We used these relationships

to indicate key aspects of each environmental class for supporting their songbird communities and used them to develop environment class-specific management strategies. We predicted the impacts of these management strategies on the richness and abundance of songbird nesting guilds using guild-specific N-mixture models. We compared these impacts to the predicted impacts of strategies applied uniformly across the study area using habitat models for the full study-area community. Indicator community-based management outperformed the uniform approach in predicted impacts on the richness and abundance of native species and most guilds, suggesting that our approach could support songbird conservation in heterogeneous urban environments.

STAYING CONNECTED: DO ARTIFICIAL CORRIDORS IN CITIES POSITIVELY IMPACT URBAN CARNIVORE OCCURRENCE?

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Rapid development can significantly compromise the persistence of carnivore populations in cities by reducing habitat size and connectivity amongst fragmented patches. It is well understood that carnivores often utilize manmade trails to traverse across seemingly impervious landscapes in cities. However, we know little about the relative salience of manmade corridors in driving patterns of spatio-temporal dynamics of carnivores in urban environments. Uncovering the importance of such corridors may inform how we design cities to positively affect carnivore populations in metropolitan environments. We investigated the hypothesis that manmade corridors (i.e., paved bike trails and railway systems), can serve to positively impact carnivore occurrence in a mid-sized city (Fort Collins, CO). To test this hypothesis, we examined the relative occupancy of two prevalent mesocarnivores across the landscape: coyotes (*Canis latrans*) and raccoons (*Procyon lotor*). We evaluate the relative importance of artificial corridors (i.e., paved bike paths, roadways) in relation to a natural control (i.e. rivers). We found that whereas proximity to a paved bike trail best predicted raccoon occurrence, rivers best predicted coyote occurrence at a site. Moreover, the proximity of a site to multiple corridor types (i.e., rivers, bike trails, and roadways) was additive, in which sites with more than a single corridor type were more likely to be occupied by both species. Our results suggest that artificial corridors can serve to increase habitat connectivity for carnivores; however, the salience of those corridors may vary as a function of species.

TRANSFORMING VACANT LOTS INTO CLIMATE RESILIENT POLLINATOR HABITAT.

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National Wildlife Federation (NWF) is creating a network of fifty climate-resilient pollinator meadows in the Mantua and Strawberry Mansion neighborhoods in the urban center of Philadelphia. The installations will provide both intra-patch connectivity as well as connectivity

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to existing protected land in Fairmount Park. These sites are part of a larger portfolio of 12,000 vacant lots that are managed and maintained by our project partner, the Pennsylvania Horticultural Society (PHS). This project will explore how cities with vacant lots can restore these sites to provide climate resilient wildlife habitat, serve as urban green stormwater infrastructure improve public health (research already completed in Philadelphia). This project is focusing on answering a number of novel research questions including: what plant species and communities thrive best on urban vacant lots, which plant communities are most desired by surrounding communities, how this network of pollinator gardens improves habitats for local pollinator species. In addition we will be researching how these pollinator sites impact stormwater retention. Beyond these provisioning and regulating ecosystem services, this project will bring additional educational, economic, and community co-benefits in the form of green jobs, prisoner reentry, education, and neighborhood stabilization and beautification.

CHARACTERISTICS OF NATIVE FRESHWATER MUSSEL SHOALS IN A LARGE RIVER: CAN VULNERABLE POPULATIONS THRIVE IN URBANIZED REACHES?

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The Pacific region has low freshwater mussel diversity, but our endemic species are found nowhere else in North America. Western Pearlshell (*Margaritifera falcata*), Western Ridgemussel (*Gonidea angulata*), and Anodonta (Floaters) occurred historically in Oregon's Willamette River, but the river has never been surveyed systematically and records are very incomplete. In 2017 and 2018, two large mussel populations in the Willamette River were surveyed intensively to characterize diversity, density, age structure, and status: one in the heart of a large city (Eugene), the other 30 miles downstream in a rural reach dominated by agricultural activity. Mussel density was higher in the rural reach (46/m² vs. 28/m²), but the ratio of live to dead mussels was five times greater in the urban reach. Although no juveniles (shell length <30 mm) were found in either, mean shell lengths were smaller in the urban population, indicating younger mussels. Both reaches were dominated by *M. falcata*. A few *Anodonta*, a more common species that prefers soft substrates in slower, warmer waters, were also present in the rural reach. A single *G. angulata* was found in the urban reach; this is notable, as this species has a more restricted distribution, is vulnerable from a conservation standpoint, and this is the most upstream record of the species in the Willamette River. While these results indicate that vulnerable species can persist and even thrive in urban settings, there are many management challenges, including pollution and direct disturbance and damage from unregulated human use of the area.

CALIFORNIA RED-LEGGED FROGS REINTRODUCED TO THE LARGEST URBAN NATIONAL PARK IN THE U.S.

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There is an ongoing, worldwide, mass extinction of amphibians. Conservation efforts to undo amphibian declines can help to reverse one of the greatest threats to global biodiversity. These efforts can be challenging in highly impacted urban landscapes, like the largest urban National Park in the U.S. – Santa Monica Mountains National Recreation Area (SMMNRA). In California, California Red-legged frogs (*Rana draytonii*) have been extirpated from 75% of their former range, and are absent altogether from the southern part of their range in the United States. In the late 1990s, a small but healthy population of California Red-Legged Frogs was found adjacent to SMMNRA. For five years, we transferred partial egg masses from this thriving ‘source’ population to predator-proof tadpole rearing pens to historically occupied streams in SMMNRA. We fed tadpoles, monitored their growth until they were large enough to avoid predators, and then released them directly into the streams. In the fourth and fifth year of our study, we discovered reintroduced California Red-Legged Frogs breeding on their own in SMMNRA, the first time in many decades. Unfortunately, in November 2018, the most destructive wildfire in the area’s history burned through the source population and all four reintroduced California Red-Legged Frog populations. We will discuss the reintroduction process, results, and future plans for the reintroduction project in light of this major setback.

MACAQUE CONTRACEPTIVE PROGRAMME IN HONG KONG.

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As part of the management plan for handling human-macaque conflicts in Hong Kong, the Agriculture, Fisheries, and Conservation Department (AFCD) launched a large scale macaque contraceptive programme in country parks since 2007. In each operation, 30-130 macaques would be trapped by using a 28 feet long remote control trapping cage. The trapped macaques would be sedated and the suitable sub-adults and adults would receive endoscopic tubectomy/vasectomy. This surgical operation involves the use of a pediatric endoscopic instrument of 3 mm diameter to cauterize and remove a portion of the fallopian tube of females or vas deferens of males. It is anticipated that endoscopic tubectomy/vasectomy would effectively control the population growth of local macaques in the long run. According to population monitoring, the birth rate of macaques in country parks has decreased from 78% in 2008 to about 35% in recent years. The total number of macaques has dropped by more than 23% in the past eight years, and has maintained at about 1,650 in the past three years. The AFCD will continue to monitor the changes of populations, and will perform contraceptive treatments for more macaques.

EVALUATING SOLUTIONS TO BIRD MORTALITY FROM COLLISIONS WITH GLASS.

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Annual mortality of birds in North America from collisions with glass is estimated at hundreds of millions. Increased adoption of strategies already in use in building design to control heat and light and enhance security can greatly reduce this mortality without sacrificing function or esthetics or increasing costs. To promote this change, it is essential to provide objective

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assessment of collision threat of materials to building professionals, similar to ratings for insulation value or breaking strength, as opposed to general recommendations like 'increase visual noise' which are difficult to use in practice. The Hohenau-Ringelsdorf Biological Station in Austria designed a protocol to compare the effectiveness of markings on glass for preventing bird collisions. The 'tunnel' is a binomial choice test where birds, protected by a net, fly either towards a test sample or unmarked control glass. Approximately 80 flights per sample are evaluated, with scores defined as percent flights to control. American Bird Conservancy determined that we could use this test with local bird taxa, at the Powdermill Avian Research Center in Pennsylvania. We have used the Powdermill tunnel to: a) determine how size, orientation and spacing of pattern elements impact effectiveness b) rate commercially available glass and c) evaluate new bird-friendly technologies. ABC also promotes legal mandates for bird-friendly design and tunnel scores are the basis for proposed Federal legislation, as well as legislation in jurisdictions across the United States, as well as forming the basis of LEED pilot credit 55: reducing bird collisions.

WILDLIFE-VEHICLE CONFLICT: AUTOMATED REPORTING AND HOTSPOT ANALYSIS.

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Wildlife-vehicle conflict (WVC) is at the intersection of wildlife ecology and transportation infrastructure. WVC incidents result in animal, as well as human, injuries and fatalities. Moreover, WVC incurs significant financial cost to individuals and governments. Analyzing spatial trends in WVC reveals locations of high and/or statistically-significant incident density, where infrastructure or policy interventions could reduce or eliminate incidents. Studies of spatial trends in WVC exist, but few accessible tools are available for Departments of Transportation and partner agencies to easily carry out their own analyses. We describe the creation of an automated, real-time WVC hotspot analysis tool (<https://roadecology.ucdavis.edu/hotspots>). The free-to-use tool was developed using data from four US states: California, Idaho, Maine, and Nevada, utilizing 72,317 WVC incidents and 44,040 centerline road miles. The project emphasizes analyses in California, where new incident data from Highway Patrol are regularly incorporated and reported (every 15 minutes), providing the world's first real-time WVC reporting system. Any state or region can upload their own data to analyze incidents on their major roads and highways. The tool uses the statistical package R and geo-processing software to produce a variety of products, including robust spatial datasets, interactive web-maps, data visualization, and statistical summaries. This tool will enable transportation planners, wildlife ecologist, and even individual drivers to gain awareness into WVC, empowering them to make informed decisions and implement mitigation measures to reduce incidents.

MOUNTAIN LIONS IN OUR BACKYARD: CONFLICTS WITH PEOPLE AND RESPONSE TO FIRE IN LOS ANGELES.

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In urban southern California, habitat loss and fragmentation threaten the conservation of wildlife populations, particularly for large carnivores such as mountain lions because of their extensive spatial requirements, low population density, and potential for conflicts with humans. Since 2002, we have been studying the ecology, behavior, and conservation of mountain lions at Santa Monica Mountains National Recreation Area. A significant challenge for lion conservation in the park is conflicts with people resulting from the loss of pets and livestock. Twelve GPS-collared lions preyed on domestic animals, 10 of which were males. We documented 96 incidents at 54 properties, resulting in the loss of 264 domestic animals: 46% goats, 23% sheep, 19% alpacas, 2 dogs, and 1 cat. Two males were responsible for 45% of depredations, all between 2015 and 2018. The vast majority of depredations occurred where animals were insufficiently protected, and confining animals in a full enclosure at night and using guard dogs greatly reduced livestock losses. Other deterrent devices and hazing techniques have shown mixed results. Another threat to wildlife conservation in the park is wildfires, which have become larger and much more frequent than they would naturally be. In 2018, the Woolsey Fire burned over half of the natural area in the park, and 11 collared animals were in the vicinity of the fire, 9 of which survived. To date, collared lions have largely remained outside both burned and developed areas, but it will be informative to monitor the use of burned and unburned areas and the effects on home range and social dynamics.

***CROP DEPREDATION BY NILGAI (BOSELAPHUS TRAGOCAMELUS) WITH REFERENCE TO HUMAN-NILGAI CONFLICT IN HUMAN DOMINATED ABOHAR WILDLIFE SANCTUARY, INDIA.**

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The area under agriculture in the Abohar wildlife sanctuary was found to have expanded over 82 percent causing much disturbance, destruction or fragmentation of wildlife habitat. Gradually, the natural habitat of nilgai has whittled down forcing them to survive near the agricultural fields. Crop damaging males raided agricultural fields significantly more than females, however, female herds were responsible for greater overall damage as female density ($6.37 + 2.06$) was higher than males ($4.37 + 1.58$) in the region. A higher extent of crop damage was recorded in the mustard crop ($46.53\% + 3.44$) as compared to the cotton ($24.6\% + 2.74$) and wheat ($19.67\% + 4.15$). An average loss of Rupees $4391.87 + 134.21$ per hectare to the farmers due to nilgai raiding was calculated during this study period. As a result of such grating human-nilgai interaction, village residents have now started barricading and protecting their fields with razor-barbed wires, cobra wires and free ranging dogs to protect their fields, which restricted the movement of nilgai resulting in more than 268 animal deaths from 2012 to 2017. During these five years, 60.12 percent of the wasteland area was brought under agriculture. Today, these problems have aggravated beyond tolerable limits and have resulted into direct conflicts between some

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people local community and nilgai to an alarming proportion. This may firmly entrench serious anti-conservation attitude and thus emerge as an important management issue and concern to the administrators and wildlife managers to safeguard people's interest and in acceptance of conservation ideals.

***SEVERITY OF HUMAN-RHESUS MACAQUE CONFLICT IN URBAN LANDSCAPE AND POSSIBLE MITIGATION STRATEGIES IN DELHI NCR LANDSCAPE, INDIA.**

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Human-monkey conflict is a serious threat to urban and suburban societies of Delhi NCR. Urban rhesus monkeys (*Macaca mulatta*) were translocated to Asola-Bhatti Wildlife Sanctuary situated at the tri-junction of Delhi. We interviewed 1568 respondents in nearby localities in and around Wildlife Sanctuary from 2016 to 2017 and obtained qualitative and quantitative information on conflict incidents. We recorded on average 14.74% cases of attack, 12.01% cases of injury, 11.15% cases of bites, 15.56% cases of snatching foods, 11.23% cases of threatening, 11.49% cases of entering into the houses, 11.36% cases of property damage and 8.27% cases of littering. We also analyzed the seasonal changes of conflict incidents. We recorded the different conflict types from affected sites from January to December and later summarized the data to get the cumulative results. We calculated 34.04% conflict cases in summer (March-June), 16.57% in monsoon (July-September), 26.28% in post monsoon (September-November) and 23.16% in winter (December-February) months. We collected data throughout the year covering all the seasons from all the 7 sites and One-way ANOVA showed that there was significant difference ($p < 0.001$) among the study sites on the occurrence of conflict incidents. Attack ($12.46 \pm SE 3.33$), injury ($10.21 \pm SE 1.61$), bites ($9.72 \pm SE 1.89$), snatching ($11.62 \pm SE 1.47$), threatening ($8.60 \pm SE 0.92$), entering into houses ($9.77 \pm SE 2.12$), breaking and damaging properties ($8.23 \pm SE 1.09$), telephone line disruption ($1.15 \pm SE 0.66$) and littering ($7.34 \pm SE 0.82$) was calculated throughout the year. Mitigation strategies to reduce conflict by population management and improvement of co-existence between local people and rhesus monkeys in the urban areas suggested.

A STUDY OF AVIAN POPULATION RESPONSE AFTER HABITAT RESTORATION USING REMOTE SENSING AND COMMUNITY SCIENCE BIRD OBSERVATION DATA.

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During the last two centuries, the contiguous United States has lost over half of its wetland habitats. Preserving the remaining wetland habitats and reversing this trend is of critical importance. Fernhill Wetlands in Forest Grove, Oregon is a natural wastewater treatment site that was transformed from unused sewage ponds to a complex natural wetland habitat in 2014-15. To assess the effect of habitat restoration on biodiversity changes, previous studies involved

comparisons of bird populations before and after habitat restoration. In this study, Landsat-8 and Sentinel-2 satellite imagery and PRISM climate data were analyzed using Google Earth Engine to calculate vegetation, water and climate indices for Fernhill Wetlands for the first time for the pre- and post-restoration periods. Then, the summary data was fed into Excel and R and quantitative correlations were established between these indices and community science bird observation data from the Cornell University eBird database. The study showed the effects of the habitat restoration, both positive and negative, on several species. Shorebirds, marsh birds and others that lived at the water's edge showed much subtler and sometimes unexpected reactions to the habitat change. Additionally, supervised machine learning classification was used to obtain clarity on land, vegetation and water changes in the region of interest. This study could be of great interest to the Fernhill Wetlands managers to help guide further habitat modifications.

SYMBIOTIC CITIES: REIMAGINING URBAN INFRASTRUCTURE AS AN OPPORTUNITY FOR, RATHER THAN IMPEDIMENT TO, WILDLIFE CONNECTIVITY.

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Urbanized areas now cover more than 106,000 square miles of the United States (U.S.), and are home to more than 80 percent of the U.S. population. Although these heavily modified landscapes are often thought of as impeding ecological health, urban infrastructure presents unique opportunities for enhancing connectivity for both humans and wildlife. Urban systems—from public transportation to transmission lines—can be designed to provide essential stepping-stones and corridors that help animals navigate human-dominated landscapes. Such “interventions” are essential, as they counter the effects of fragmentation and climate change, while simultaneously enhancing livability and connectivity in cities for humans. In 2016, Studio-MLA (a landscape architecture and urban design firm with offices in Los Angeles and San Francisco) began partnering with the National Wildlife Federation to identify ways to increase connectivity in the second largest metropolitan region in the United States—Los Angeles, California. The goal of the effort was to investigate how humans can lessen urbanization's negative impact on wildlife by using urban infrastructure and systems to enhance, rather than impede, connectivity for both humans and wildlife.

DEVISING URBAN CONNECTIVITY MODELS FOR THE NORTHERN RED-LEGGED FROG (RANA AURORA).

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Urban connectivity models ensure location-specific wildlife movements are protected in rapidly changing environments. As a provision to the Metro Regional Habitat Connectivity Toolkit, movements of Northern Red-legged frogs (*Rana aurora*) were tracked with radio telemetry and compared to modeling results with Circuitscape 4.0 and Least Cost Path Analysis. Modeled movement pathways may best represent adult frogs that are moving terrestrially through

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overland vegetation within 1,000 meters of their stormwater breeding site. However, the models may disagree with fine scale movement where frogs encounter fragmented forest, wetland, and urban features within short dispersal distances less than 500 meters. By tracking the frog's movement between wetland and upland habitat, they may cross varying stages of urbanization and connectivity. This necessitates the use of an urban permeability index which compares select pathways ranging from low to high combinations of habitat quality and barrier strength. A dynamic species scoring process may better represent quality and connectivity of habitat in highly fragmented urban areas beyond what habitat percentage or configuration can determine. We expect frog connectivity pathways will be less directionally variable at short distances within low scoring habitat, high scoring barrier locations. They will be more directionally variable at farther distances in high scoring habitat with low scoring barriers. By comparing low and high scoring pathways with tracked movement pathways, we can determine the margin of error for these connectivity models and improve upon the Toolkit scoring system. The results allow practitioners to devise habitat connectivity strategies for sensitive species in urbanizing place.

NEST SITE CHARACTERISTICS OF RED-TAILED HAWKS IN NEW YORK CITY.

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Little is known about the nesting behaviors of red-tailed hawks in urban environments. For this project, we sought to gather more information about the factors that impact nest site selection for red-tailed hawks in New York City. We gathered active nest site locations throughout New York City during the spring 2017 raptor breeding season, and monitored nest site activity and productivity. In 2018, we recruited citizen science monitors to help gather more detailed nesting information. Using Maxent software for modeling species distribution, we developed a presence-only model of red-tailed hawk nesting sites to generate a probability distribution surface indicating high and low predicted probability of suitable nest site locations. We modeled nest locations using six predictor variables, including distance from NYC Parks' property, distance from identified rat reservoirs, surface elevation, land cover class, and two separate measures of land cover diversity. We found that distance from NYC Parks' property was the most effective variable for predicting nest site location among red-tailed hawks.

URBAN BREEDING RAPTORS IN ENSENADA, BAJA CALIFORNIA, MÉXICO.

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Urban raptors have found or developed tolerance to human activity and landscape transformation, even for breeding behavior. In some cases, raptors may also find a city resource plentiful. However, cities represent bigger risks for wild fauna. Half of admissions in rehabilitation centers around the world, are labeled as trauma or collisions including: cars, buildings/windows, fences, electric wires or moving structures. These sources of threat to

raptors, are rarely found with no road system surrounding them. We selected the road system surrounding breeding territories in Ensenada, Baja California. Differences in home ranges for the breeding species diversity found was considered. The road system categories followed governmental classification as: 1) highway, 2) streets and 3) roads. These classifications and their proximity to the nest, described the landscape type of the territory, while the densities of each road system within the nesting territories provided the pressure on the nesting activities. 19 nesting territories were found representing six species of diurnal raptors. Productivity showed positive low correlation with pressure and negative low correlation with landscape. The most pressured species was *Accipiter cooperii* +0.53, and *Pandion haliaetus* +0.43, followed by *Falco peregrinus* +0.30, *Falco sparverius* +0.27, *Buteo lineatus* +0.23, *Aquila chrysaetos* +0.03. Productivity trends, are considered similar to other reports with some exceptions. It is considered, that both increasing the reach and continuance of the territories monitoring may provide better understanding of the urbanized ecosystem dynamics for avian predators and ecosystem services provision by raptors, if any.

THE INFLUENCE OF NEIGHBORHOOD LANDSCAPE CHARACTERISTICS ON NATIVE BIRD COMMUNITIES. IMPLICATIONS FOR INCREASING BIODIVERSITY IN OUR YARDS.

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The aim of this study was to investigate anthropogenic drivers of urban bird communities in three Portland, OR neighborhoods (Hillsdale, Lents, and Pearl). Is there evidence that the urban matrix may host similar avian community assemblages as neighborhood green space? I found that increased distance from large parks is associated with decreases in richness, abundance, and diversity. Are landscape characteristics able to predict native bird communities? I determined that avian communities were best predicted using local landscape characteristics within a 10ha buffer. My study found that since Portland neighborhoods varied in magnitude of anthropogenic disturbance, I saw a simplification of urban bird communities along a suburban-urban gradient. As less urban tolerant guilds, such as foliage gleaners, drop out of the community, they are seen to be replaced with a greater abundance of ground foragers, omnivores, and invasive species.

ASSESSING THE RELATIONSHIP BETWEEN SMALL SCALE VEGETATION METRICS AND POLLINATOR VISITATION IN SE PORTLAND.

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This project examined if we were providing the most preferred floral resources at enhanced pollinator sites for bees, if floral resources were available throughout the season in South East Portland. Bee pollinators were monitored from June to August at three enhanced pollinator sites in South East Portland, Oregon. Additionally, it was found that honey bees and native bees had little dietary overlap. Floral resource composition shifted between sites and months, with all sites having drastically reduced floral richness in August indicating diverse floral resources were not available throughout the season. Recommendations for managing enhanced pollinator sites included planting more late season plants, adding bare, non-compacted dirt at sites for nesting

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material and scheduling regular site care and watering at enhanced sites.

ASSESSING MAMMAL COMMUNITIES IN AN ARID URBAN PRESERVE USING A NOVEL FUNCTIONAL TRAIT APPROACH.

Katherine C. B. Weiss, School of Life Sciences - Arizona State University, kcweiss@asu.edu; Courtenay A. Ray, School of Life Sciences - Arizona State University; Jan Schipper, Arizona Center for Nature Conservation - Phoenix Zoo; Sharon J. Hall, School of Life Sciences - Arizona State University.

Species filter into cities through interactions between organisms, the environment, and people. Functional traits that allow a species to move from regional to local species pools have been hypothesized as likely mechanisms for urban community assembly. Though some work has been done to connect functional traits to urban species persistence, disagreement exists on how to measure and compare functional traits, especially across mammals. We apply a new functional trait framework to urban mammalian systems that standardizes functional trait assessments and allows for cross-taxa comparisons. We hypothesize that urban mammal community composition reflects physiological constraints as defined by functional traits, and advocate choosing traits that most likely respond to studied phenomena and that relate to community assembly rules (e.g., selection, speciation, drift, and dispersal). To test our hypothesis, we use camera trap data collected in Arizona's McDowell Sonoran Preserve from May 2017- May 2018. For mammals in our study area, we evaluate behavioral, physiological, and cultural traits that influence an individual's ability to adapt to human-dominated environments, including activity pattern, body size, dentition and nutritional physiology, home range plasticity, behavioral plasticity, social structure, and facial structure. We review the literature to classify body size, dentition and nutritional physiology, behavioral plasticity, social structure, and facial structure and use occupancy analyses and kernel density functions to identify home range plasticity and activity patterns. Our results test a novel functional trait approach that can be used to support the assessment and conservation of urban ecological communities across the U.S.

BACKYARD HABITAT CERTIFICATION PROGRAM.

Nikkie West, Portland Audubon, nwest@audubonportland.org; Susie Peterson, Columbia Land Trust.

The Backyard Habitat Certification Program (BHCP) provides technical assistance, incentives, resources, and recognition to private property owners to restore native wildlife habitat, control invasive weeds, reduce pesticides, and manage stormwater at home. The program is designed to increase effective management of privately-held lands by partnering with communities and by leveraging the time, labor and skills of nearly 100 volunteers and 5250 program participants - spanning nearly 1500 acres. Together we accomplish crucial ecological outcomes, while fostering lasting behavior change and engendering a lasting ethic of stewardship. As development and the population in the Portland metropolitan area grows at an unprecedented rate - from 2.1 million people today to 3.2 million people in 2030 - it is a priority to enlist the

help of city residents in efforts to combat environmental burdens. The BHCP directly responds to this call to action by engaging urban and sub-urban residents as partners in conservation. The objectives of the program are to increase the public's awareness of the benefit of conservation in the metropolitan area and to incentivize continual, measureable on-the-ground habitat enhancements in five key areas; 1) remove invasive species, 2) enhance native vegetation in their yards, 3) reduce pesticides, 4) steward wildlife and 5) improve stormwater management. Through these activities, participants gain an understanding that their backyards play a role in supporting broader conservation efforts and are part of a landscape-wide ecosystem of solutions.

THE RESPONSE OF AN URBAN-EXPLOITING RAPTOR TO DEVELOPMENT INTENSITY IN THE SUBURBAN LANDSCAPE.

Elizabeth H. White Rose, University of Florida School of Natural Resources & Environment, ehwhite@ufl.edu; Raoul K. Boughton, University of Florida Range Cattle Research & Education Center.

Understanding the mechanisms by which native wildlife takes advantage of urban habitats is essential for the long-term conservation of these species in changing landscapes. We conducted a study to evaluate what aspects of the developed environment influence occupancy, successful reproduction, and space use in urban-exploiting Florida Burrowing Owls (*Athene cunicularia floridana*) in two suburban southwest Florida cities in 2017 and 2018. Using GPS backpacks, we measured the movements of 27 adult male Burrowing Owls for up to 15 nights during the time when they were provisioning young, collecting an average of 247 locations per individual. We found that the amount of space used by males (95% UD) is negatively related to local population density, but density and productivity have no relationship. Additionally, the percent of parcels that are developed (i.e. have a house or park) within the 95% UD is negatively related to the amount of space used, and local Burrowing Owl density increases with development level. However, this relationship between suburban development and the amount of space that Burrowing Owls require was dependent on year and may be mediated by precipitation preceding the nesting period. To further investigate this pattern, we will determine if provisioning males are selecting yards and parks over vacant lots during hunting forays. These data suggest that the resource changes associated with the conversion of vacant land to suburban uses increases the availability of prey within these areas, and if sufficient nesting sites are preserved, Burrowing Owl populations may persist in developed Florida landscapes.

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DISCOVERY OF AN ESTABLISHED POPULATION OF AMBLYOMMA AMERICANUM IN SOUTHWESTERN CONNECTICUT.

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In June 2017, the first established population of lone star ticks (*Amblyomma americanum*) in Connecticut was documented on Manresa Island in Norwalk. While it is the major human-biting tick in the southeast, its range is currently expanding northward along coastal New York and New England. Known populations are established on Long Island, NY, on Prudence Island in Rhode Island's Narragansett Bay, and more recently on Cape Cod, Martha's Vineyard, and Nantucket, MA. We speculate that a warming climate with milder winters are facilitating this coastal range expansion. The 50-ha Manresa Island site is peninsular in nature and has an estimated 50 white-tailed deer (*Odocoileus virginianus*) resulting in a relative density of 100 deer/km² (250/mile²). On the back of the ears of 11 deer captured in May-June 2018, parasitizing lone star adult and nymphal estimated densities ranged from 17 - 2,400 ticks/100 cm². We also documented incredible questing adult, nymphal, and larval densities of 21, 154, and 2,600 ticks/100 meters², respectively during their peak activity. Intervention utilizing 4-poster devices in summer 2018 likely did little to curb population growth as deer are less likely to be drawn to bait with numerous alternative food sources available during the growing season, when lone star ticks are most active. This anomalous and significant population of lone star ticks in Connecticut is of great interest and concern. We are planning further experimental intervention into the future in an attempt to manage this isolated source population of lone star ticks in the interest of public and wildlife health.

PUBLIC STREET-TREE PREFERENCES BY BIRDS IN THE LOS ANGELES URBAN FOREST: THE INFLUENCE OF TREE ORIGIN AND SOCIOECONOMICS.

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The Los Angeles metropolis (LA) is home to one of the most diverse urban forests on the planet. Approximately 20% of the urban forest is composed of street trees, which are public resources planted adjacent to sidewalks, median strips of roads, or public-rights of way. Despite the representation of street trees in the LA urban forest, little is known about their distribution and value to wildlife, which presents a gap in our understanding of conservation in the urban ecosystem. Here, we quantified foraging behavior by migratory and resident bird species on native and exotic street trees across a socioeconomic gradient throughout LA. We found a higher diversity, density, and size of street trees in affluent areas than more disadvantaged

communities, which in turn, attracted a greater number of foraging migratory birds, and to a lesser extent, non-migratory birds. Foraging migratory and non-migratory birds strongly preferred native street trees such as Coast Live Oak (*Quercus agrifolia*) and California Sycamore (*Platanus racemosa*) in greater proportion than they were available on the urban landscape. However, a handful of exotics tree species, including Chinese Elm (*Ulmus parvifolia*) and Southern Live Oak (*Quercus virginiana*) were also used in higher proportion than they were available, suggesting some exotic tree species provide valuable foraging resources for native birds. Our findings demonstrate the importance of native street trees, and to a lesser extent, exotic street trees, as important habitat for birds. Further, our results highlight needs for street-tree management in impoverished communities throughout LA.

HOST AND ENVIRONMENTAL PREDICTORS OF ANTIMICROBIAL RESISTANCE IN URBAN MESOCARNIVORES.

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Wildlife exposure to antimicrobial resistant (AMR) bacteria has been extensively reported, especially in human dominated landscapes. However, it is unclear whether exposure is solely driven by environmental context or whether wildlife traits (e.g. species, age, sex) are also important. Disentangling these relationships is crucial for understanding how AMR bacteria are disseminated in the environment, and what the consequences might be for public and animal health. As a model for this issue, we investigated whether wildlife exposure to clinically-relevant resistant bacteria was a function of spatial location in urbanized landscapes, and how patterns varied for different wildlife species. Samples and rectal swabs were collected from coyotes, raccoons, and opossums from 3 urban and 4 suburban sites in northwestern Chicago between December 2017 and 2018. We found urban animals to have a higher prevalence of resistant bacteria than suburban animals. Interestingly, we also detected species-level differences. In preliminary results, raccoons had a higher prevalence, followed by coyotes and subsequently opossums. Our findings highlight that proximity to urban areas is an important predictor of shedding AMR bacteria, and that some wildlife species may play a more important role in the dissemination of antimicrobial resistance than others.

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REINTRODUCING A NATIVE FRESHWATER MUSSEL TO AN URBAN LAKE.

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Freshwater mussels serve an integral function in aquatic ecosystems through their filter feeding. With the on-going restoration of the Presidio National Park of San Francisco's Mountain Lake a number of flora and fauna reintroductions have been ongoing over the last six years, including Anodonta mussels. These mussels, last recorded in the lake in 1948, are declining throughout the western states and have a complex life history making reintroductions a challenge. As parasites of fishes, these mussels require a host fish to complete their lifecycle. After applying a piscicide in the lake to eradicate the entire non-native fish community, the three-spine stickleback (*Gasterosteus aculeatus*) was reintroduced for a number of reasons including that of mussel host fish. Anodonta source populations were identified throughout the greater Bay Area and brooding females collected. Through a collaboration with Missouri State University, in vitro propagation via bypassing the host fish stage, allows for the amplification of juvenile mussels resulting in higher numbers than would occur naturally. Additional in vitro stickleback inoculation protocols have been developed and implemented to promote semi-natural recruitment in the lake through a catch-inoculate-release program. Collaborators at Stanford University carried out experiments using live mussels in flow-through tanks at the lake to quantify Anodonta's filtration rate of 177-246 ml/hr as well as confirm the consumption and de-activation of *E. coli*. The reestablishment of these mussels will improve the lake's water quality while bringing attention to the value and plight of these organisms to an urban audience.

***EBOLA, PSYCHOLOGICAL MODELS OF PEOPLE'S ACCEPTANCE FOR CONSERVING FOREST RESERVES VERSUS COMMUNITY FORESTS IN SOUTHERN BENIN.**

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Out of international terrorism, climate change, global recession and financial crisis that posed problem to the mankind wellbeing the last decade, Ebola virus outbreak was also a worldwide sanitary concern that at various degree impacted people-forest relationships. The study aimed to determine psychological variables that most influence people's acceptance to conserve forest islands in the current context of Ebola virus outbreak in Africa. Individual interviews were carried out on 600 respondents sampled around four community forests and four forest reserves. Cronbach's α was calculated to describe the internal consistency and reliability of multi-items used for measuring of psychological latent variables. Structural Equation Modeling was carried out to estimate relationships between variables. Items used for measuring people's acceptance to conserve forest islands were consistent and reliable (all Cronbach's α were greater than 0.5). Perceptions of risks associated with Ebola outbreak had the highest impact on local people's acceptance level with supportive intentions in community forests against oppositional

intentions in forest reserves. Communities' pessimism is enhanced by low social trust toward forest and health services in urban and rural areas respectively and limited people's abilities to protect themselves from Ebola vectors. Psychological models suggested more participatory approach in forest reserves. Forest services' interventions in urban areas and concerted actions with health services in rural areas are necessary to raise an individual's trust in managing agencies in order to reduce perceptions of risks and heighten perceptions of benefits for a greater people's acceptance to live in harmony with forest islands.

NON-TRADITIONAL PARTNERSHIP TO CONSERVE URBAN BAT SPECIES AND PROMOTE SCIENCE LITERACY IN THE NORTH CAROLINA PIEDMONT.

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Accredited zoos and aquariums often partner with academic institutions, government agencies and not-for-profits to broaden the impact of scientific research, conservation outreach and community awareness to preserve various species and habitats. The Greensboro Science Center (GSC), in Greensboro, provides the North Carolina Piedmont region with a science education resource, a family attraction, and a conservation and research partner. At the University of North Carolina at Greensboro (UNCG), science outreach is conducted on multiple levels not only benefiting students' abilities to communicate science to the public, but also broadens science participation and enriches the community's knowledge and awareness of science. UNCG and GSC are neighbors and natural partners with similar goals of science discovery and literacy through like-minded goals and cooperative efforts. Our UNCG – GSC collaborative includes an acoustic project that monitors urban bats activities below, within, and above of the urban forest canopy at GSC. We investigate questions on urban bat phenology, foraging behavior difference in relation to canopy height, and seasonal bat diversity variations. The project will bring awareness of urban influences on bat conservation and an understanding of how Piedmont bats in an urban setting use the forest canopy to visitors of the GSC. At the same time, the project will contribute to graduate research projects at UNCG and service as a long-term stationary data collection site for the North American Bat Monitoring Program in North Carolina. We will also demonstrate how similar partnerships have been developed with other zoos, aquariums, and education centers in North Carolina.

CITIZEN SCIENCE OBSERVATIONS PROVIDE UNIQUE INSIGHT INTO SALAMANDER DISTRIBUTIONS WITHIN URBAN ENVIRONMENTS.

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Citizen science is rapidly amassing novel observational data with the potential to aid in studying species distributions, especially in urban areas. We test the extent to which citizen science data impacts our understanding of salamander distributions across the highly urbanized Los Angeles Basin, comparing species distribution models (SDMs) using only historical museum records to SDMs using only contemporary citizen science data. Our results show that citizen science

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based SDMs result in more broad distributions of *Batrachoseps* salamanders that extend further into urban areas, demonstrating an important difference between historical museum records and citizen science data. We further validate the models using modern citizen-science guided museum collections, with a combined museum and citizen science based SDM as the best supported model. These results suggest that citizen science data provide unique information that expands our understanding of the distribution of *Batrachoseps* salamanders beyond what is known from historical museum collections. The presence of these species throughout the city raises the question of whether these are understudied, isolated remnant populations or if urbanization has instead resulted in an expansion of salamander populations into newly created habitats where irrigation has led to year-round availability of moist soil in a historically seasonally dry landscape. These results highlight the utility of citizen science projects for studying urban species.

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*Indicates abstract was accepted, but the author was unable to present.

CAT MANAGEMENT PREFERENCES OF FERAL CAT & WILD BIRD ADVOCATES IN THE USA: WHERE STAKEHOLDERS AGREE AND DISAGREE.

Sabrina Aeluro, University of Washington, sabrinaaeluro@gmail.com.

One of the most inflammatory topics in animal welfare and wildlife conservation is the management of feral and free-roaming cats, a conflict that gets framed as a war between “cat people” and “bird people.” While studies of these groups have been conducted previously, there was a need for a more comprehensive understanding of how they view methods of cat management, including approaches currently in development. The purpose of this online survey was to quantify on a national level how self-identified feral cat advocates and wild bird advocates rate 37 methods of cat management with a focus on discovering where stakeholders have the most and least agreement. This was the largest study to date regarding opinions around cat management, with a total of 2559 respondents (1276 feral cat advocates and 1283 wild bird advocates) from across the United States. Challenging the stereotype of polarized factions, respondents agreed on two key issues: 82.6% of wild bird advocates and 75.4% of feral cat advocates wanted a large reduction in the number of feral cats, and 61.7% of wild bird advocates and 73.7% of feral cat advocates believed it’s possible to find ways to work together. Cat management methods geared towards prevention received strong support from both groups, but there was disagreement over lethal methods. This demonstrates that while stakeholder preferences are not perfectly aligned, they are also not mutually exclusive. This work illuminates areas of common ground where these seemingly disparate groups could work together to tackle the complex problem of cat overpopulation.

EVENNESS OF BIRD SPECIES ALONG A RESIDENTIAL GRADIENT IN WAKE COUNTY, NORTH CAROLINA.

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As urban population growth continues to rise, it becomes more important than ever to understand how anthropogenic drivers of the urban-rural gradient can affect the composition of wildlife that inhabit it. Although many studies have been conducted on bird species diversity across the urban-rural gradient, not many have focused on evenness. This study will evaluate the composition between generalist and specialist species as well as non-native and native species that occur in residential areas. The results will be collected by conducting bird counts around different housing types and densities within two populous cities in Wake County, North Carolina. In an addition, sound levels will also be recorded at morning rush hour for each site.

The evenness of bird species between generalist and specialist is predicted to be greater for lower density housing, while the evenness between non-natives and natives is predicted to be greater for higher density housing. This study will be used to determine if species diversity can persist in areas of residential urban sprawl. As housing development continues to meet the needs of urban populations, conservation of both native and specialist species will rely on the integration ecology and city planning.

MONKEY BEETLES IN THE CITY - URBAN POLLINATORS IN SERVIDES AND POS.

Peta Brom, UCT, brompeta@gmail.com; Les Underhill, UCT; Jonathan Colville, SANBI.

Monkey Beetles of the tribe Hopliini are important regional pollinators in Southern Africa where nearly half the world's species occur. Many specialized relationships have driven the evolution of endemic floral species, most notably that of the iridaceae. Cities have been demonstrated to provide good habitat for some pollinators due to landscaping management practices and urban heat island effect that provide longer flowering seasons. Yet no urban studies of hopliini have been conducted to date. This study sought to determine the relationship between urban land-use patterns and hopliini beta-diversity. Early results show complex interplay of a range of patterns including historical legacy, urban intensity and size and connectivity of fragments.

THE INVASION ECOLOGY OF IVY IN PORTLAND'S FOREST PARK.

Eric Butler, Portland State University, ebutle2@pdx.edu.

I am presenting results from a study on the invasive plant ivy (*Hedera* spp.) in a large Pacific Northwest urban forest, looking at sources of invasion vulnerability and resistance on the plot and landscape scales and how these relate to the overall health of an important ecosystem under urban stress. The factors I analyze include canopy cover, soil condition, interiority, understory shrub abundance, and fragmentation by roads and trails, as well as the spatial patterns of ivy distribution in the park. My findings will likely have important implications for how ecosystem managers think about and manage ivy in urban landscapes.

EFFECTIVE NO-POISON RODENT CONTROL.

Rebecca Dmytryk, Humane Wildlife Control, help@humanecontrol.com.

Eliminating rats and mice from structures and reducing their populations without the use of poison is absolutely possible. Humane Wildlife Control is a leading expert in resolving rodent intrusion using non-lethal methods. This presentation will cover the practice of exclusion and eviction and how the non-lethal approach helps to guarantee a building is rodent-free. We will also look at examples of exclusion devices used in the yard and garden, the effectiveness of certain repellents, and the most ethical, humane lethal options for the overall control of rodent populations.

RESOURCE SELECTION OF URBAN RED FOXES (VULPES VULPES) IN LINCOLN, NE.

*Kyle Dougherty, School of Natural Resources, University of Nebraska-Lincoln, kyle.dougherty@huskers.unl.edu; John Benson, School of Natural Resources, University of Nebraska-Lincoln
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The use of sentinel species, which enhance the probability of detecting a disease in the environment, is a common method of disease surveillance. Red foxes (*Vulpes vulpes*) may be useful as a sentinel species due to their ability to adapt to human-altered landscapes and frequent proximity to humans. Currently, a lack of information regarding urban red fox ecology in Nebraska makes it difficult to determine what factors contribute to zoonotic disease prevalence in the fox population of Lincoln, NE (human population = 275,000). Gaining knowledge of habitat types used by foxes is an important step in effectively utilizing their potential as a sentinel species. We estimated home ranges for 9 GPS collared foxes and modeled third order (within home range) resource selection. Home ranges averaged 2.67 km² in size and were composed primarily of low, medium, and high intensity development, developed open spaces, and smaller amounts of herbaceous and agricultural areas. Our models show strong support for sex-specific differences in resource selection. Both sexes strongly selected developed open spaces, such as golf courses and parks. Males avoided medium intensity development more strongly than females, and females selected both low and high intensity development while males neither selected nor avoided those habitat classes. Our work provides the first detailed information about urban fox ecology in Nebraska. The observed sex-specific patterns of habitat selection may reflect similar differences in the diets of male and female foxes and have the potential to influence disease exposure.

BIRD COMMUNITY ON OFFICE DEVELOPMENTS IS EXPLAINED BY DEVELOPMENT AND LANDSCAPING ACTIONS IMPACTING VEGETATION COMMUNITIES.

Karen Dyson, University of Washington, karenldyson@gmail.com.

Human actions including development, tree removal, tree and shrub planting, and creation of impervious surface influence vegetation communities in urban ecosystems. For bird conservation efforts to be successful in cities, the habitat matrix in which preserves and remnant habitat are situated must provide sufficient resources for local species. Understanding the relationship between bird communities and the outcomes of human action at the parcel-scale can help guide policy and management best practices to improve matrix habitat quality. Here, I ask what socio-economic and land cover site context variables and variables describing the outcome of development, landscaping, or maintenance actions explain variation in winter foraging bird community composition on commercial property in King County, Washington, USA. I quantified the bird communities and observed feeding behavior, collected data on vegetation communities, and quantified parcel-scale outcomes of development, landscaping, and management actions. I used cluster analysis, regression, and multivariate ecology tools including PERMANOVA. I found that parcel-scale variables are more important in explaining variation in bird communities than neighborhood-scale variables. Bird community composition on office developments is influenced by the outcome of development and landscaping actions, including the age and density of native trees and the density of native shrubs on a parcel. These findings suggest that preserving and planting native conifers and native shrubs can

support local bird communities on office developments in King County, WA. They also suggest an important role for developers, land owners, landscape architects, and tree protection policy in urban bird conservation.

CONNECTIVITY AMONG POPULATIONS OF PACIFIC TREEFROGS (PSEUDACRIS REGILLA) IN THE PORTLAND METROPOLITAN AREA.

Marissa Eckman, Pacific University; Rylee Trendell, Pacific University; Katie Holzer, City of Gresham; Lauren Chan, Pacific University, lchan@pacificu.edu.

Anthropogenic changes to habitat can create strong barriers to dispersal and gene flow among populations of amphibians. Isolated populations may experience increased inbreeding, a loss of genetic diversity, and are at greater risk of local extinction. Landscape genetics is an approach that can be used to understand how geographic and environmental features affect the genetic diversity and movement of individuals within a species. We investigated genetic diversity and population connectivity in the Pacific tree frog, *Pseudacris regilla*. We genotyped individuals from over 10 populations at five microsatellite loci. We compared levels of genetic diversity and genetic differentiation to landscape features to determine if specific habitat types impede gene flow. We found that geographically distant populations tended to exhibit greater divergence. However, in preliminary analyses, we did not detect an effect of specific habitat features on genetic diversity.

***TOWARDS POST-SPECIES SPACES.**

Trace Fleeman y Garcia, Oregon Institute for Creative Research, sci4ch@gmail.com.

Much contemporary discourse informing attitudes towards wildlife is based on the single proposition that humans and nonhumans belong to, and belong in, different spaces, with a few acceptable interlopers in the form of domesticated animals, animals-as-property, interspecies families, and so forth. The concept of "urban wildlife," in and of itself, throws the status quo into question and represents a conceptual advance, for what has not yet been adequately theorized are new types of post-species arrangements and dynamics. As an ecologist and eco-activist, I am interested especially in the possible vacuum that might arise with the demise of species-ism, considering such a possibility as both a challenge and an opportunity for rethinking the notion of species as well as imagining radically different relationships and arrangements between humans and other animals. With this presentation, I seek to outline not a political program but various spaces for post-species possibilities, both sacred and profane.

FROM PRISON TO HABITAT - ENGAGING INCARCERATED VOLUNTEERS IN A LAKE RESTORATION PROJECT.

Diana Foss, Texas Parks and Wildlife, diana.foss@tpwd.texas.gov.

A shortage of volunteers and native plants can hamper a conservation project, but a group of Texas Master Naturalists have discovered a way to multiply their efforts to get plants in the ground. The Heartwood Master Naturalist chapter has been working with the Texas Dept of Criminal Justice (TDCJ), Texas Parks and Wildlife Dept, and other organizations to revegetate the banks at Lake Livingston to reduce erosion and create small fish habitat. Lake Livingston

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provides drinking water for four Texas counties and the City of Houston. Habitat loss due to development along the water's edge and siltation has decreased wetland habitat and contributed to the decline of the lake's fish community. The lake's recovery necessitated a multi-step process - educating the community, obtaining large quantities of native plants, and planting wetland patches. The keys to the first two steps are inmates at the nearby TDCJ Ellis Unit. The Master Naturalists and instructors from agencies and other organizations provide an extensive training class at the prison. The TDCJ inmates then use this knowledge to utilize the horticultural supplies at the Ellis Unit to grow wetland plants. The overall program is a win-win for everyone. For TDCJ inmates, the program provides career training and helps them form a connection to natural resources. For Lake Livingston, the wetland restoration project is gradually improving the water quality and fish populations within the lake.

INTRAGUILD INTERACTIONS WITHIN CARNIVORES IN DETROIT METRO PARKS.

Gabriel Gadsden, Applied Wildlife Ecology, Ecology and Evolutionary Biology, University of Michigan, ggadsden@umich.edu; Rumaan Malhotra, Nyeema C. Harris, Applied Wildlife Ecology, Ecology and Evolutionary Biology, University of Michigan.

As humans continue to expand where they live and play, the chances of altering the behavior of wildlife increases. Major U.S. cities, where human populations are highest and habitat fragmentation is most severe, pose a important place to study this phenomenon. We used an extensive camera trap survey, deploying over forty cameras in Detroit Metro Parks to study carnivore ecology during Fall/Winter in 2017-2019. Park attributes differed in size, habitat structure, proximity to major roads, human detection rate, and presence of coyotes (*Canis latrans*). We aim to assess determinants of occurrence for mesocarnivores (e.g., grey fox -*Urocyon cinereoargenteus* and red fox -*Vulpes vulpes*). We hypothesized that both species of fox will be detected more often in parks where there is little coyote activity and that closely mirror forest habitats. Naive estimates of occupancy (without correcting for imperfect detection) was 0.375 and 0.175 for coyotes and red fox, respectively. However, these two species only co-occurred at two parks that were relatively small sized in comparison to green spaces throughout the city. Our findings will allow expanding cities to better manage the potential problems of attracting wildlife and educate the public about the wildlife that inhabit their cities.

HUMAN-CARNIVORE CO-OCCURRENCE PATTERNS IN DETROIT METRO PARKS.

Siria Gamez, University of Michigan, sgamez@umich.edu; Rumaan Malhotra, Nyeema Harris, University of Michigan.

The United Nations estimates that by 2050, 68% of the human population will live in urban areas. Some wildlife species are struggling to adapt to urban life while others are able to exploit anthropogenic resources in cities. Which species can survive and thrive in an urban ecosystem has tremendous implications for the structure of ecological communities as well as human-wildlife conflict and disease transmission. Studies have sought to elucidate how some species

of birds and pollinators are using urban parks, however, our understanding of how mammalian communities, particularly carnivores, are co-existing in these spaces is limited. We deployed over forty cameras across the Detroit Metro Parks from November 2017 to March 2018 to study the carnivore community. We detected the presence of seven mammalian carnivore species and used a probabilistic species co-occurrence analysis to detect any negative or positive associations between humans and carnivores. We predicted negative associations between humans and both canid species, coyote (*Canis latrans*) and red fox (*Vulpes vulpes*), however, our predictions were not supported by the data. We found that only raccoons (*Procyon lotor*) and humans have a significant, negative co-occurrence pattern, all other pairs were found to co-occur randomly. These findings suggest carnivores are still using urban parks despite high levels of human activity but further work must be done to better understand these patterns.

***DAILY ACTIVITY PATTERNS OF RELOCATED URBAN RHESUS MACAQUES (MACACA MULATTA) IN A HUMAN-DOMINATED LANDSCAPE, DELHI AND ITS IMPLICATION IN MANAGEMENT.**

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We observed behavioural activity patterns, daily movements and reproductive ecology (birth rate, death rate, breeding seasons, mating) of urban rhesus macaques (*Macaca mulatta*) in man-made environment after their reintroduction in city-based protected area known as Asola-Bhatti Wildlife Sanctuary, Delhi, India. The daily activity patterns of rhesus macaques were observed from 0600h to 1800h per day from February 2016 to June 2017. Macaques adopted different time phase for maximum utilization of all the resources available in that area and we estimated the percent time spent of each activity pattern and their variations. Flexibility in activity patterns helped them to adjust in a human-dominated landscape successfully but human-macaque interactions in the mosaics of forest and urban areas increased several degrees of conflict. This study was essential to understand the spatial ecology and behaviour of urban rhesus macaques to develop further action plan for conservation of natural habits and management of proliferative rhesus macaques and co-existence with humans in urban environment.

Keywords: Rhesus macaque; Translocated; Activity pattern; Human dominated landscape; Delhi

PHYLOGENETIC ANALYSIS OF THE CANINE DISTEMPER VIRAL STRAINS CIRCULATING IN ONTARIO WILDLIFE.

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Canine distemper virus (CDV) causes generalized disease in domestic dogs. Vaccination is used to prevent infection since once the virus is acquired, it is untreatable and has a high mortality rate. Traditionally considered a disease of domestic dogs, CDV is now known to have a broad and expanding mammalian host range. In Ontario, CDV is frequently encountered in wild

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carnivores and is the most common infectious cause of death for raccoons and skunks. The potential for close contact between dogs and raccoons and skunks, particularly in urban areas where they often live at high densities, leads to opportunities for CDV transmission. The recent isolation of CDV strains genetically distinct from vaccine strains in North America highlights the importance of studying the molecular epidemiology of this virus. While canine distemper is considered endemic in Ontario wildlife, the molecular identity of circulating strains is unknown. The objective of this study is to identify the CDV strains that are circulating in Ontario wildlife and compare these to the strains covered by current vaccines. Samples were opportunistically collected from carcasses submitted to the Canadian Wildlife Health Cooperative, where CDV was suspected. Reverse transcription-PCR was used to confirm CDV diagnosis and the hemagglutinin gene was sequenced. Reference genomes representative of the major vaccine strains were obtained from Genbank. MEGA v10 was used for phylogenetic analysis. This study will provide baseline data on the wild-type CDV strains that are circulating in Ontario and will allow us to track future changes in this important virus.

MULTIPLE VALUES OF URBAN SCHOOL GARDENS.

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Harrisonburg, Virginia USA is home to James Madison University (JMU) and a city population of highly diverse nationality, language, and economic background. Many public school students live in built environments without green space. JMU Geographic Science undergraduates implemented a vegetable and wildflower garden at a public school in April 2012 in order to build a living laboratory for elementary students and to provide a wildlife study site for students of all ages. Since 2012, a garden culture has developed and the program has expanded. JMU students now work with five public school gardens. Each year, undergraduates create learning tools to increase public school student interest in sustaining the gardens and use of the gardens for learning about ecosystem processes such as pollination, seed dispersal, and butterfly metamorphosis. Undergraduates also engage in garden activities during summer school, fall and spring recess, and during winter garden club. While the original objective of the garden program was to create a space for urban children to learn about food growth and animals of the garden, other outstanding benefits include the relationships that have developed between university students and public school students from diverse backgrounds. The garden program has also led to the development of relationships between university faculty and other city entities. This presentation summarizes the value of the garden program, including how the garden program benefits public school students, city-wide relationships, and urban biodiversity.

CONTINUOUS TIME MOVEMENT MODELS AND HOME RANGE SIZE: ECOLOGICAL ADVANCES IN SPACE USE BETWEEN URBAN AND RURAL BLACK BEARS.

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Olfenbittel, North Carolina Wildlife Resources Commission; Christopher S. DePerno, North Carolina State University.

As urbanization continues, human land use has become increasingly sprawled leading to a landscape of fragmented natural land cover interspersed throughout urban environments. Landscape fragmentation has resulted in humans and wildlife living in greater proximity to each other, and thus, an increase in human-wildlife interactions. Accurately estimating space use and understanding movement behaviors can provide insight into best management practices and inform conservation strategies associated with urban wildlife management. We fit continuous time movement models (ctmm) and estimated annual and seasonal home ranges using Autocorrelated Kernel Density Estimation for a multi-year comparison of urban and rural black bears. Movement analyses using ctmm methods are designed to handle irregular VHF or GPS sampling schedules (including gaps in the data) as well as high frequency and complicated autocorrelation in the data. We expect our results to provide larger estimates of home range size than those previously reported from conventional methods (i.e., KDE's) due to the tendency for earlier methods to underestimate home range size when presented with autocorrelated movement as well as produce estimates that are limited to the study timeline (e.g., less than annual). We expect movement distances for urban bears to be shorter and quicker on average than their rural counterparts. Additionally, we expect urban bear home range size will be smaller than rural bears due to year-round anthropogenic food subsidies. Results from this project will provide a valid comparison of space use between an urban and rural bear population with differing data collection methods using modernized estimation techniques, and will directly be used to develop and inform science-based management strategies for bear populations in urban environments.

ECOLOGY AND CONSERVATION OF THE WILDLIFE COMMUNITY IN UTAH'S WASATCH MOUNTAINS ALONG A WILDLAND-URBAN INTERFACE: A CITIZEN SCIENCE APPROACH.

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The Wasatch Mountain Range (WMR) contributes to Utah ranking tenth amongst states in total biodiversity and fifth in total endemism. However, the WMR also contains some of the most highly recreated National Forests in the country, trafficked by roughly 9,000,000 people every year (equal to all five of Utah's National Parks combined). Additionally, nearly 50% of Utah's growing population lives within what is known as the WMR wildland-urban interface, where human activity and infrastructure come in direct contact with undeveloped land. Consequently, Utah ranks fifth in the nation in proportion of species at risk of extinction. There is a lack of research into how wildlife abundance, distribution, and behavior is affected by human activity, hampering the ability of wildlife managers, urban planners, and policy makers to make sustainable development decisions in the future. This project looks to bridge this knowledge gap by asking: In a rapidly urbanizing world, what are the relationships between varying human influence and how wildlife behave, adapt, and move through their environment? Leveraging the power of trail cameras and one of the most successful community science efforts to date, we

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are gathering data from over 200 monitoring locations throughout the WMR and Salt Lake Valley green spaces. These data will be used to identify changes in species-specific distributions, temporal activity patterns, and spatiotemporal co-occurrence frequencies in relation to different human activity levels, as well as create predictive spatial models that identify areas on the landscape in need of protection, urban planning focus, and habitat restoration efforts.

UNDER-REPRESENTATION OF COMMUNITY APPROACHES IN THE STUDY OF URBAN SMALL MAMMALS.

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With their high taxonomic and ecological diversity, small mammals (Orders Rodentia, Scandentia, and Eulipotyphla) are of great importance to biological conservation and management across a range of systems. Within urban areas, it is particularly unclear whether and how many small mammal species persist and drive ecological processes, such as disease dynamics, predator-prey interactions, and seed dispersal. In addition to focusing on individual species, comprehensive studies of urban small mammals and their potential ecological roles require approaches that assess how entire communities respond to the anthropogenic activities associated with the complex processes of urbanization. Evaluating how urban small mammal studies have focused on community-level approaches would aid researchers in identifying directions for better understanding and managing the persistence of wildlife within cities. We used Web of Science and Google Scholar databases as well as in-manuscript citations to conduct a systematic review of published information on urbanization and small mammal taxa, assessing when, where, and how small mammals have been studied within cities. Results indicate that urban ecological studies that focus on small mammals are abundant among studies also referring to urban mammals more broadly. However, urban small mammal studies focused more heavily on epidemiology and individual species of management concern, with much attention given to the most abundant few species that are problematic or charismatic to people. Relatively fewer studies took community-level approaches that investigate how small mammal communities contribute to a wide range of ecological processes, which is critical for better understanding urban ecology across systems.

URBAN GREEN JAYS: HABITAT USE IN THE LOWER RIO GRANDE VALLEY.

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Southern Texas hosts more than 500 species of birds during any given year. Some of these species are found nowhere else in the United States, like the Green Jay (*Cyanocorax yncas*). Green Jays are integral parts of the local economy, drawing in bird watchers from all over the country. In 2015, the Rio Grande Valley of Texas (RGV) was ranked as the 3rd fastest growing

MSA in the country. Significant urban growth causes large losses to native habitats, despite an economic interest in incorporating bird habitat into new developments. Urbanization is one of the leading causes of habitat loss worldwide. Currently, 55 per cent of the world's population lives in urban areas, projected to increase to 65 per cent, or 6 billion people, by 2050. Therefore, there exists a need to understand how wildlife adapt to anthropogenic sources and land use in order to better instruct management. Species like the Green Jay exist on the northern periphery of their range in South Texas; however, some of these species have demonstrated the ability to adapt to urban areas while others remain restricted in their ranges. Despite their economic importance and limited ranges, little to no research exists on Green Jays and their needs in respect to habitat use, diet, or home range in urban environments. Texas Parks and Wildlife Department have begun a research project studying habitat use by Green Jays in the RGV to provide recommendations to urban policy makers for these and other urban bird species.

INDIVIDUAL DIFFERENCES IN A FORAGING EXTRACTION TASK OF URBAN LONG TAILED MACAQUES (MACACA FASCICULARIS).

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Natural selection pressures in urban environments have been suggested to be accelerated compared to undisturbed areas that are subjected to traditional evolutionary timescales. Additionally, individual differences have been reconsidered as some of the basic building blocks upon which natural selection can act upon. Historically, individual-level differences have been largely ignored in animal behavior research. However, this has gotten increased attention in recent years as scientists have come to appreciate that variation among individuals may cause them to interact differentially within their environment. Therefore, quantifying these individual differences in the urban environment is of great importance to understand natural selection pressures in a rapidly changing world. Individuals that live in anthropogenic environments often experience fluctuating environmental factors such as altered resource availability due to human activities. Due to this, foraging extraction tasks are ecologically relevant for quantifying individual variation in cognition among individuals in urban settings. Individual variation in problem solving abilities (or even merely willingness to participate) is important as it may confer benefits and/or costs differently to each individual. This study investigates the individual level differences and consistencies in the problem-solving abilities of two groups of long-tailed macaques (*Macaca fascicularis*) in a highly urbanized area of Kuala Lumpur, Malaysia. We tested a familiar task (opening a plastic water bottle for a juice reward) with individual long-tailed macaques to assess individual differences in problem-solving abilities. Our results indicate that there is a high level of variation across individuals in which techniques they use to solve the task. Additionally, the majority of individuals are consistent across trials in their problem-solving technique. Finally, attributes such as rank, sex, age and interactions with humans were tested in their ability to predict whether the individual is able to solve the task quicker than others.

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***THE SEATTLE URBAN CARNIVORE PROJECT: MONITORING THE IMPACTS OF URBANIZATION ON MAMMALIAN CARNIVORES THROUGH CAMERA TRAPPING AND CITIZEN SCIENCE.**

Mark Jordan, Seattle University, jordanma@seattleu.edu; Robert Long, Katie Remine, Woodland Park Zoo.

The Seattle metropolitan area is one of the fastest growing urban areas in the United States. Within a short distance of ~40 km, this region transitions from densely urbanized to a native forest that hosts a relatively intact native mammalian predator community. We have launched the Seattle Urban Carnivore Project to better understand the impacts of urbanization on the mammalian carnivore community across this gradient while also engaging local citizens with the wildlife living within this rapidly-growing urban area. We have deployed camera traps, monitored by both staff and volunteers, along two transects extending from downtown Seattle to the edge of the metro area, and these data contribute to the continent-wide Urban Wildlife Information Network. We have also launched a web-based tool – Carnivore Spotter – to collect carnivore sighting data from citizens across the region. We will present an overview of the project, a preview of the Carnivore Spotter website, and preliminary results from our first season of camera trap surveys.

EDUCATION & BYLAW ENFORCEMENT TO REDUCE HUMAN-BEAR CONFLICT - REVIEW OF THE CITY OF COQUITLAM'S URBAN WILDLIFE PROGRAM.

Julie Kanya, Urban Wildlife Coordinator, City of Coquitlam, jkanya@coquitlam.ca.

Coquitlam, British Columbia is a fast growing community bordering on the Pacific Range of the Coastal Mountains. As development continues and residential populations move further up the mountains, the City faces an ongoing challenge of coexisting with wildlife. With a population of over 125,000 residents and projection of an additional 24,000 people moving to the Burke Mountain area, human contact with wildlife is inevitable. Province-wide Coquitlam reports the highest instances of bear conflicts (over 1000 conflict reports and 7 bears destroyed each year on average). Since establishing a seasonal Bear Aware Program in 2005, Coquitlam has initiated extensive measures to reduce human-bear conflict. The program evolved to be year-round and now targets the full range of wildlife found within the community. The urban wildlife program traditionally focused on education to reduce human wildlife conflict rather than bylaw enforcement. However conflicts continued despite consistent efforts to educate the public. In response to a high profile human-bear incident in 2016 City staff significantly increased the frequency of patrols of the City for unsecured garbage as well as the use of bylaw enforcement for non-compliance. Unprecedented citywide audits for garbage compliance were conducted in 2017 and 2018 to identify neighbourhoods of concern and monitor overall adherence to bear smart bylaws with a 2019 audit planned for this upcoming spring. The poster presentation will provide an overview of Coquitlam's urban wildlife program, discuss the use of education and bylaw enforcement to reduce human-bear conflicts, and review the results of the garbage compliance audits.

CAN RAPID EVOLUTION OF POLLUTION TOLERANCE HELP CONSERVE AMPHIBIANS IN PACIFIC NORTHWEST URBAN STORM WATER FACILITIES?

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Chemical pollutants in freshwater habitats may limit amphibian colonization and persistence in urban ecosystems. If and how different amphibian species can tolerate aquatic pollution remains an open question. We increasingly realize that some species can rapidly evolve in response to novel stressful environments, including human-modified ecosystems. These evolutionary changes can happen in a matter of several generations, rather than centuries or millennia as previously envisioned by evolutionary biologists. Rapid evolutionary change may help some amphibian populations locally adapt to urban pollution. Alternatively, some species may be relatively plastic in their tolerance of pollutants. In other scenarios, some species may be too susceptible to contaminants and may not have the opportunity to tolerate urban freshwater systems. Understanding these different ways that different populations and species of amphibian respond to urban contaminants will alter how we approach urban management aimed at increasing population connectivity, mitigating pollution, and translocating individuals. Beginning in 2020, we are initiating a set of field experiments coupled with intensive chemical analyses in storm water ponds in the Portland, OR and Seattle, WA areas to test whether two species of amphibian can rapidly adapt or plastically tolerate urban storm water pollution. Our focal species are the red-legged frog (*Rana aurora*), a species of conservation concern that is declining range-wide in the Pacific northwest, and the chorus frog (*Pseudacris regilla*), a common species expected to plastically tolerate a wide range of stressful conditions. We are using the results of these initial experiments to guide subsequent management experiments aimed at understanding how population differences in pollution tolerance influence amphibian management strategies.

COYOTE MANAGEMENT PLANS AT FACE VALUE.

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Although coyotes often evoke conflicting and polarized views, their biological resilience permits them to thrive and expand across a variety of landscapes. Their versatility lets them transfer from the wild to the city, often choosing urban areas to live and raise their young. This has resulted in regular interactions with humans which has necessitated the development of management plans. Many communities have supported this popular movement as a statement toward formalizing and enacting policy intended to alleviate the risks associated with human-coyote encounters. However there has been no comprehensive assessment of the plans, nor the animals they seek to manage. To evaluate their efficacy, an assessment tool was created to reviewed specific areas of the management plans by their inclusions or exclusions, such as wildlife co-existence, mitigation techniques, and applications for on-the-ground practices. Additionally, an automated content analysis software program was utilized to identify key thematic concepts resulting in visual maps.

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URBANIZATION EXACERBATES THE DECLINE OF WHITE-NOSE SYNDROME AFFECTED BAT SPECIES.

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The impact of urbanization on bats is species-specific. Limited information is available about the effect of urbanization on three species of bats, the little brown (*Myotis lucifugus*), northern long-eared (*Myotis septentrionalis*), and tricolored (*Perimyotis subflavus*) bat. All three species have been declining due to white-nose syndrome. Using data collected through the North American Bat Monitoring Program in North Carolina between 2015 to 2017, we constructed dynamic occupancy models to investigate how urbanization would affect occupancy, local colonization, and local extinction probabilities. We found that urban land cover was negatively associated with occupancy probabilities of all three species and positively associated with local extinction probabilities for northern long-eared and little brown bats. Using future land cover data, we predicted future occupancy and found that land cover change could cause the highest declines in regions where white-nose syndrome is prevalent. Undeveloped habitats should be protected to prevent local extinction for these species.

A WILDLIFE EXCLUSION SERVICE (AWES).

Michael McGuire, Sonoma County Wildlife Rescue, Petaluma, CA, AWES@scwildliferescue.org; Doris Duncan, Sonoma County Wildlife Rescue Petaluma, CA.

A Wildlife Exclusion Service (AWES) helps homeowners and business owners throughout Sonoma County and in parts of Lake County and Napa County with nuisance wildlife issues. We are the top in humane wildlife control and get to the bottom of every situation, no matter how bizarre. What is Exclusion? Exclusion is the humane and life-oriented approach to pest control. Techniques are applied to remove intrusive animals and prevent future use of a building or home by wildlife. Rather than trap and relocate animals, which is illegal and can expose wildlife to diseases and territorial conflicts, AWES technicians identify how an animal is getting in and seal points of entry without trapping the animal inside. The solution motivates the animal to leave the property and reduces the likelihood of other animals getting in. Exclusion is ultimately more effective, more economical, and far more humane than most other services. We focus on the main issues, removal of the animal and sealing of the entry points to keep wildlife from returning.

INCIDENTAL SIGHTINGS MAP PROJECTS: TOOLS FOR RESEARCH AND OUTREACH.

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Citizen sightings maps can be useful tools both to engage the public and collect data on target species or other ecological units. We use the experiences from two citizen science map projects, the Portland Urban Coyote Project and the District Coyote Project, to illustrate how small research projects and non-profits can build robust and successful sightings maps using low- or no-cost tools. Consideration is given to all stages of project development and implementation, including outreach and promotion, map creation, sightings report forms, data management, and the use of data collected through these citizen science projects. In addition, we will compare free, specialty licensing for non-profits, and enterprise options to help researchers and program directors make an informed decision about whether or not to invest in paid versions of the programs we examine. Finally, we discuss plans to continue this conversation with the citizen science community at-large in an effort to improve sightings projects and encourage new ones to be developed.

THE SAFE WILDLIFE CROSSINGS DESIGN FOR THE INTERSTATE 15 FREEWAY.

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The Safe Wildlife Crossings Design for the Interstate 15 Freeway is a project undertaken by a team of engineering students at California State Polytechnic University, Pomona in collaboration by a team at UC Davis. This group of students, with assistance from a collection of multidisciplinary professionals involved in wildlife conservation, are working together to develop effective and feasible solutions to creating safe wildlife crossings for the Santa Ana mountain lions and other wildlife. The area of study is between the City of Temecula and the San Diego County line on the Interstate 15 Freeway. Over the course of the last 15 years, this area has seen a high frequency of vehicle strikes on mountain lions, compounding the increased threat of extinction Santa Ana mountain lions face due to a lack of genetic diversity. Data gathered by The Nature Conservancy organization and ecologists have been utilized to accurately track mountain lion movements and reproduction rates through camera recordings, global positioning system activity using collars, and droppings. Development of the safe wildlife crossing infrastructure began in August 2018. Applying collected data and guidance of wildlife professionals, the team worked on feasible solutions to the isolation of the Santa Ana mountain lions and the inability for wildlife to cross the I-15. The team has developed three proposals for the community to address the issue of safe wildlife crossing: an overpass, an underpass, and an underground culvert. These proposals have been advanced through workshops with The Nature Conservancy, California Department of Transportation, Fish and Wildlife, Boeing, and other agencies concerned with wildlife conservation.

***CONNECTING THE COMMUNITY OF WEST LINN TO NATURAL PROCESSES THROUGH THE PARKS & REC PROGRAM BEAVER AMBASSADORS.**

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In 2017 citizens of West Linn responded to a city-wide survey resulting in a clear need for more environmental engagement. Beaver Ambassadors was created to fulfill that need. Beaver Ambassadors is a West Linn Parks & Rec program with three primary objectives: (1) provide

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community engagement through unique events and social media, (2) educate West Linn schools on the importance of urban wildlife and habitats using the beaver as a primary tool, and (3) provide management plans for beaver conflicts in West Linn parks. Where possible, we seek to overlap these objectives in an effort to ensure the bulk of the community grows together in understanding the importance of urban habitats and the unique role beavers play on the urban ecosystem.

DETERMINING THE PREVALENCE OF TOXOPLASMA GONDII IN THE SYRACUSE URBAN DEER POPULATION.

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Toxoplasma gondii, a parasitic protozoan, causes the disease toxoplasmosis in its host. Found worldwide, it's capable of infecting any warm-blooded animal, but can only reproduce in cats. Its presence has been studied in domestic cats before, and other hosts, but there's little literature published on other hosts' roles in transmission. Studies found antibodies to *T. gondii* in white-tailed deer, suggesting they can be infected. This indicates deer may contribute to this parasite's transmission to cats, potentially as intermediate hosts, thus posing a potential health risk to humans if deer carry and spread *T. gondii*. To determine the prevalence of *T. gondii* in Syracuse, DNA was extracted from twenty-six samples of deer feces collected from six parks across Syracuse. Primers specific to *T. gondii* were designed and PCR was used to detect oocysts of *T. gondii* present in the samples. PCR products were separated by size using gel electrophoresis and six samples were determined to be positive for *T. gondii* DNA. Current and future research involves sending positives for commercial DNA sequencing and collecting new samples from additional locations around Syracuse. With these data, the deer in Syracuse will be mapped to determine the prevalence of infected deer across Syracuse. This study aims to establish an understanding of the role that deer play as intermediate hosts in the transmission of *T. gondii*, providing insight into the frequency of contact between domestic cats and deer and the probability of deer contracting the parasite from cats and facilitating this parasite's dissemination throughout Syracuse.

FILLING IN DATA GAPS WITH CITIZEN SCIENCE AND BIOBLITZ EVENTS.

Miguel Ordeñana, Natural History Museum of Los Angeles County, mordenan@nhm.org; Lila Higgins, Richard Smart, Natural History Museum of Los Angeles County.

BioBlitz events have historically provided the scientific community with opportunities for taxonomic experts to conduct intensive biodiversity surveys in areas that are of interest to various stakeholders. Evolving from 24-hour surveys that are limited to specific geographic areas, now BioBlitz events can leverage mobile and online technology to engage people locally and globally. The Natural History Museum of Los Angeles County (NHM) uses various BioBlitz

formats to meet the needs of both scientists and non-scientists. We will share three BioBlitz formats and related case studies, which offer distinct benefits and challenges for the organizing teams. 1. Self-hosted Events: Self-hosted BioBlitz events provide the host with the agency to target areas beneficial to their ongoing projects and manage events according to their best practices. Challenges include limitations on staff and resources. 2. Partnership Events: Partnering with another organization increases capacity, particularly the ability to engage new audiences. Alterations to the event content and format may be required in order to meet the needs and goals of one's partnering organization. 3. Competition Events: Competitions engage the competitive spirit and civic pride of participants. Global competitions allows the host and international partners to engage previously untapped audiences. Logistical challenges and barriers increase as competitions grow; balancing the needs and goals of the host and its partners also becomes more difficult. Expanding the format and definition of BioBlitz events come with challenges, but we argue the benefits of filling in data gaps by expanding the scope and scale of biodiversity surveys, outweigh the costs.

ESTIMATING URBAN PARROT POPULATIONS AND DETERMINING LANDSCAPE CHARACTERISTICS OF ROOSTS IN SOUTHERN CALIFORNIA.

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At least ten species of introduced parrots can be found living in urban California environments which are dominated by human-made structures and non-native, ornamental vegetation. In San Diego, urban parrots have been heavily documented for over 40 years, however primary literature is lacking and shows a gap in knowledge since the 1990s. Considering these parrots are thriving in urban environments where people are available to observe and potentially report sightings of these birds, it may not be adequate enough to establish population estimates. With the assistance of undergraduate researchers, we aim to estimate parrot population size based on roost surveys during the breeding season and modify this survey protocol to fit their seasonal movements. Furthermore, we will utilize spatial analysis software to determine landscape characteristics of roost sites during the breeding season. Knowledge of population size and methods with which to efficiently monitor these birds can aid in detecting population changes and parrot responses to the urban landscape which are not often captured with other bird survey efforts. In addition, knowledge of roost site characteristics can aid in identifying potential human-wildlife conflict areas and impacts on native wildlife inhabiting the same areas.

SPECIES IDENTIFICATION THROUGH 16SRRNA ANALYSIS IN WILDLIFE FORENSICS.

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In veterinary field species identification has gained wide application in the recent past. Illegal trade, poaching and habitat destruction wiped out many species of animals, birds and reptiles from the earth. So it is high time to develop a specific and sensitive method for species

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identification. Traditional species identification methods rely mainly on protein based techniques which cannot be applicable in case of decayed, processed and fixed samples. Nucleic acid based techniques, especially mitochondrial DNA based techniques proved to be more specific when compared to protein based techniques. It is difficult to develop separate molecular technique for the identification of each species on earth because of its diversity. In the present study we have selected a universal primer pair to target 16SrRNA sequence to amplify homologous gene sequences from wide variety of species which includes reptiles, birds and animals. Polymerase chain reaction conditions were standardized for wide variety of samples, amplicons were then sequenced. Analyses of the sequences were carried out using suitable software. Molecular biology techniques along with bioinformatics tool provide an advanced, specific and an easy method of species identification.

PELECANUS: CONSERVATION CONVERSATIONS.

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Have you ever noticed that most of what you see on the news reflects on the bad? Especially when it comes to our environment. Not only is the world dying, there's nothing you can do about it. Turns out, many people are doing something about it, every day. That's where we come in. Pelecanus: Conservation Conversations is a podcast and website focused on sharing the stories of the people and organizations that are making it their purpose to grow the conservation field, to make the right the wrongs of our past, and to show how people have and still are making monumental positive differences in our world through research and action. In this talk we will share the lessons learned, the good news and inspiring stories of the players in the conservation world from the first dozen or so episodes. We will highlight a wide variety of efforts focusing on urban wildlife, California condors, community-based conservation efforts in the Peruvian Amazon and the efforts to recover white bark pine in a Crater Lake National Park, among other efforts that are becoming increasingly important with increased urbanization. Join us as we share these stories and show that we can find optimism through science, action and perseverance. Pelecanus.org

CONFLICTS BETWEEN HUMANS AND BIRDS OF PREY IN SAO PAULO, BRAZIL: AN 11-YEAR RETROSPECTIVE STUDY.

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Sao Paulo is the largest city in Latin America and the eighth most populous city in the world. Thus, human-birds of prey conflicts become inevitable due to both, the exacerbated population growth and the urbanization of, previously considered, rural areas. The Wildlife Rehabilitation Center of Tiete Ecological Park (CRAS-PET) is located in the East zone of São Paulo and receives annually about 270 birds of prey of the orders: Accipitriformes, Strigiformes and Falconiformes.

This presentation consists of a retrospective study from 01/2008 to 01/2019, where it will be detailed: species affected, main injuries, age group, season of the year and locality within the city of São Paulo from where these animals were rescued. From the analysis of such data, we will discuss ways of mitigating the risks of human-birds of prey conflict as well as create strategies to better treat these birds.

THE INDIRECT EFFECTS OF HABITAT FRAGMENTATION ON SQUAMATE SPECIES RICHNESS IN SOUTHERN CALIFORNIA.

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Los Angeles is one of the largest urban areas in the world. This rapid urban sprawl has created many scattered habitat fragments, which can have negative consequences on wildlife diversity and dispersal. I will explore the relationship between squamate diversity and habitat fragmentation in Thousand Oaks, California. I will capture snakes and lizards, identify to species, and record length and sex in order to quantify species diversity and population composition within 25 habitat fragments varying in size and age. I expect to find differences in species composition between patches based on its unique biotic and abiotic characteristics such as patch age, size, percent urban buffer, and habitat heterogeneity. My study will be the first to examine the indirect effects of habitat fragmentation on squamate diversity in Southern California and will help to better understand the challenges local wildlife face due to urbanization.

SPATIO-TEMPORAL PATTERNS OF BROWN RAT AND FREE-ROAMING CAT POPULATIONS IN THE CITY OF CHICAGO.

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In cities, free-roaming cats are a suggested rodent population control method but the interaction between cats and rats is relatively unexplored. Programs like trap-neuter-release have become a popular method used to control rat populations across the US. I will examine the spatial and temporal patterns of the brown rat (*Rattus norvegicus*) in Chicago, the “rattiest” city in USA, using 10-years of citizen-contributed data from the Chicago Bureau of Rodent Control, and Animal Control and Rescue. Rat complaints will be used as an index of rat relative abundance, as these factors are highly correlated. Free-roaming cat complaints will be used as estimated relative abundance of cats. Complaints will be categorized, mapped, and analyzed within Chicago’s 90 zip-codes. If free-roaming cats influence rat abundance, we predict that the relative abundances of these species will be synchronous but negatively correlated. We will test this prediction using multiple regression matrices including five distance matrices.

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THE EFFECTS OF URBAN NOISE POLLUTION ON BAT ECHOLOCATION AND HABITAT SUITABILITY IN SYRACUSE NY.

Alexandra Sheehan, Le Moyne College, Syracuse, NY, sheehalm@lemoyne.edu; Jason Luscier, Le Moyne College, Syracuse, NY.

Urbanization has resulted in increased landscape fragmentation with both physical and non-physical barriers. Noise pollution represents a non-physical barrier across which lots of wildlife will not pass, effectively fragmenting urban environments into noisy areas and quieter areas. Specifically, wildlife that utilize echolocation for locating food, identifying predators, etc. may experience drastic effects from noise pollution. Some of the most well documented affected wildlife are whales and dolphins, but little research has been done in the wild on how noise pollution affects bats, specifically their ability to hunt and navigate appropriately. We used a bat detector to record echolocation frequencies at sites representing various levels of urbanization throughout central New York. Across these sites, urban noise levels ranged from 50.2 to 79.4 dB. We found that average echolocation frequency decreased 0.9 kHz for every 1 dB increase in urban noise. Based on presence/absence data in conjunction with the recorded noise pollution, we are modeling habitat suitability for bats across the city of Syracuse, NY. Habitat suitability maps will help wildlife managers in planning for the conservation of urban bat communities.

DOES ECOLOGICAL RESTORATION BREAK A FEEDBACK LOOP BETWEEN BIRDS AND INVASIVE PLANTS, PROMOTING REGENERATION IN URBAN WOODLANDS?

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Patches of remnant and regenerating forest are important components of urban landscapes, providing refuges for native biodiversity and essential environmental benefits for people. Urban stressors affect these woodlands, including frequent human disturbances, small patch size, pollutants, urban warming, and species introductions. These species include invasive climbing woody plants, often dispersed by birds, that thrive along edges of small forest patches and may be suppressing tree regeneration in forest gaps. Cities across the globe are responding to these challenges with ecological restoration. To better understand how invasive plants and ecological restoration affect urban forest regeneration, we sampled light environment via hemispherical photography and vegetation density using a modified cover pole technique at multiple heights from the forest floor, in 30 invaded and 29 restored urban forest patches located within 5 parks across New York City. Invaded sites were dominated by multiflora rose (*Rosa multiflora*, climbing shrub), porcelain-berry (*Ampelopsis glandulosa*, liana), and oriental bittersweet (*Celastrus orbiculatus*, liana), which are primarily bird-dispersed. In restored sites, invasive plants had been removed and native species were planted over 20 years prior to sampling. We found that patterns of light availability at the soil surface, and above the herbaceous and shrub forest strata, differed between restored and invaded sites, indicating greater canopy closure due to

establishment and growth of planted trees. Unrestored sites offered dense cover, which may suggest a positive feedback loop in which bird-dispersed species are maintained in the soil seed bank that is disrupted by ecological restoration of urban woodlands.

***HUMAN-LEOPARD CONFLICT AND CONSERVATION IMPLICATIONS IN PAURI GARHWAL SUB-URBAN LANDSCAPE, INDIA.**

Netrapal Singh Chauhan, Amity Institute of Forestry and Wildlife, Amity University, nschauhan@amity.edu.

We investigated the problem of human-leopard conflict in Garhwal hills, India. Due to degradation, fragmentation and loss of habitats, leopards have become ecologically dislocated and resorted to attack on human beings and livestock. Now human-leopard conflict has attained alarming proportion and is affecting conservation ideals. Information on human casualties and livestock killings was collected from the forest department and through interviews of affected people. During 2004-2017, leopards were responsible for 328 human casualties. A total of 328 human casualties were reported in Pauri Garhwal during these years. Attacks on females were more (n=166) than males (n=162). Out of 328 cases, 146 people were killed and 182 injured. Among 146 killings, there were 61 males and 85 females. During, 2004, 2005, 2008, 2010 and 2013, number of human casualties was 43, 21, 24, 40 and 41 respectively. Maximum human casualties occurred in August (n=44), followed by 40 casualties in March. There were more than 60% cases of women and children. Thirty cases occurred between 1601-2000 hours and 20 cases during 0801-1200 and 1201-1600 hours. Leopard were responsible for 463 livestock killings in Pauri Garhwal during 2004-2017. Maximum cases (n=200) occurred in 2003. Cow, bull and goat/sheep suffered maximum killings, i.e. 213, 123 and 93 cases respectively. Highest number of killings (n=68) was in the age group of 2.6-5 years. Among livestock killings, 293 cattle were with the graziers, 100 cattle were without graziers, and 67 killings occurred in cowsheds. Mitigation strategies to reduce human-leopard conflict are suggested.

***ISSUES RELATED TO MANAGEMENT OF PROBLEMATIC LEOPARDS IN URBAN AND SUB-URBAN LANDSCAPES IN INDIA.**

Netrapal Singh Chauhan, Amity Institute of Forestry and Wildlife, Amity University, nschauhan@amity.edu.

We investigated the issues related to human-leopard interactions and management of problematic leopards in urban and sub-urban landscapes in India. First-hand information has been collected from human dominated landscapes: cities, towns and peripheries on occurrence of leopard into human habitation, human-leopard interactions, rescuing leopard, and mitigation of human casualties during the year 2015-2018. Due to degradation, fragmentation and loss of habitats, leopards have become ecologically dislocated and resorted to attack on human beings and livestock. Many a times, leopards entered in houses and attacks on people or forest staff. As a result, human-leopard conflict has attained alarming proportion and affecting conservation ideals. Information on number of cases of human casualties and livestock killings, leopard venturing into houses, falling into well or traps was collected from the forest department and surveying affected areas. All these case studies will be presented and discussed.

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CARNIVORE POPULATION STRUCTURE ACROSS AN URBANIZATION GRADIENT: A REGIONAL GENETIC ANALYSIS OF BOBCATS IN SOUTHERN CALIFORNIA.

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In California, urbanization is a leading cause of habitat fragmentation. To understand the impact of urbanization on landscape connectivity in southern California we created a landscape level bobcat genetic analysis including samples from previously published bobcat genetics and from new samples, including two outgroups from northern California for comparison. With a rigorous inter-sample and inter-lab validation methodology, we performed a comprehensive analysis using 19 microsatellite loci for 118 individuals and 11 loci for 422 individuals. We then conducted hierarchical analyses of population genetic structure and examined how pairwise genetic distance of all population clusters aligned with geographic distance using the 19 loci dataset. Lastly we employed a landscape resistance analysis to determine which features of the landscape likely play a role in the determining the patterns of genetic structure we observed among bobcats in southern California. We found that bobcat populations were largely delineated by busy freeways and development rather than geographic distance, which caused geographically isolated populations such as Golden Gate and Orange County (OC) Coastal to be genetically distinct from their neighbors. In contrast, San Diego and OC Inland, which have no major anthropogenic barriers to movement between them, were both genetically and geographically related. Permeability, which captures both developed and natural landscape features, was the strongest predictor of the observed patterns of genetic variation across southern Californian bobcats. Our results highlight the importance of analyzing genetic patterns at multiple scales and understanding how the differences between local and regional patterns can affect conservation and management decisions.

MIGRATORY SONGBIRD RICHNESS ON MILITARY TRAINING LANDS IN INTERIOR ALASKA -WHERE INCREASING ACCESS DEVELOPMENT MIGHT HAVE THE GREATEST IMPACT.

Justin Smith, Colorado State University, J.Smith@colostate.edu; Garrett Savory, Kim Jochum.

Coquitlam, British Columbia is a fast growing community bordering on the Pacific Range of the Coastal Mountains. As development continues and residential populations move further up the mountains, the City faces an ongoing challenge of coexisting with wildlife. With a population of over 125,000 residents and projection of an additional 24,000 people moving to the Burke Mountain area, human contact with wildlife is inevitable. Province-wide Coquitlam reports the highest instances of bear conflicts (over 1000 conflict reports and 7 bears destroyed each year on average). Since establishing a seasonal Bear Aware Program in 2005, Coquitlam has initiated extensive measures to reduce human-bear conflict. The program evolved to be year-round and now targets the full range of wildlife found within the community. The urban wildlife program traditionally focused on education to reduce human wildlife conflict rather than bylaw enforcement. However conflicts continued despite consistent efforts to educate the public. In response to a high profile human-bear incident in 2016 City staff significantly increased the frequency of patrols of the City for unsecured garbage as well as the use of bylaw enforcement for non-compliance. Unprecedented citywide audits for garbage compliance were conducted in 2017 and 2018 to identify neighbourhoods of concern and monitor overall adherence to bear smart bylaws with a 2019 audit planned for this upcoming spring. The poster presentation will provide an overview of Coquitlam's urban wildlife program, discuss the use of education and bylaw enforcement to reduce human-bear conflicts, and review the results of the garbage compliance audits.

PRELIMINARY ACOUSTIC SURVEYS OF BATS IN PORTLAND'S URBAN PARKS.

Pamela Thompson, Portland State University, thompson@pdx.edu; Olyssa Starry, Portland State University; Kevina Vulinec, Delaware State University.

Several bat species and populations in North America are under threat from White Nose Syndrome (WNS), which has been characterized as the largest wildlife epidemic in the past century. WNS was detected in Western states for the first time in 2016, highlighting the need for studies on bats in this region. We conducted preliminary acoustic surveys of bats in parks around Portland, OR during late summer 2017, using sites previously surveyed by Portland Metro in 2008. We used a Pettersson's M500 microphone to detect bat calls, and identified them to species using Sonobat's automatic classification. There were substantial differences in the species detected in the same site, across the different years of sampling, although one park had consistently high diversity. Notably, no hoary bats (*Lasiurus cinereus*) were detected. Future work will focus on surveying bats at more locations, to determine ecological constraints on species occurrences.

EFFECTIVE USE OF CARBON MONOXIDE (CO) TO CONTROL GROUND SQUIRREL AND GOPHER POPULATIONS.

Duane Titus, Humane Wildlife Control, help@humanecontrol.com.

This talk will present the benefits and effectiveness of using the PERC (Pressurized Exhaust

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Rodent Control) system of delivering carbon monoxide into ground squirrel gopher tunnels to control their populations without the risk of secondary poisoning of predator species. We will also discuss the recommended criteria for its use.

ASSESSMENT OF HELMINTH BIODIVERSITY IN LOS ANGELES COUNTY COYOTES (CANIS LATRANS).

Amanda F. Tokuyama, Ecology & Evolutionary Biology Department, University of California, Los Angeles, atokuyama@g.ucla.edu; Sarah K. Helman, Ecology & Evolutionary Biology Department, University of California, Los Angeles; Justin L. Brown, Santa Monica Mountains National Recreation Area, National Park Service; Seth P. D. Riley, Ecology & Evolutionary Biology Department, University of California, Los Angeles, Santa Monica Mountains National Recreation Area, National Park Service; Jamie Lloyd-Smith, Ecology & Evolutionary Biology Department, University of California, Los Angeles.

Coyotes (*Canis latrans*) can be highly adaptive to densely populated urban environments due to their opportunistic nature and high survival rate. These animals often carry various parasites of public health and veterinary concern, including *Trichinella* and *Cryptosporidium*. In areas where coyotes and humans live in close proximity, there is increased risk for pathogen spillover into humans and domestic animals, which, in turn, can lead to spillback into wildlife populations. However, little is known regarding the diversity and general prevalence of gastrointestinal parasites in coyotes and how the influence of rapid and expanding urbanization may affect the risk of these spillover events. In order to address this, we will collect parasite samples from coyote gastrointestinal tracts through collaborations with local wildlife rehabilitation centers, animal control, and wildlife management agencies. We will then map parasite occurrence patterns against urbanization indices, which will provide insight into the distribution of parasites across the urban landscape. Consequently, this will allow us to make more accurate predictions regarding parasite and pathogen prevalence and transmission potential, enabling us to work closely with local wildlife, veterinary, and public health agencies to mitigate these risks. This work will be paired with concurrent research on other pathogens of concern, behavioral ecology, and population genetics to increase our understanding of disease dynamics and population connectivity in this urban system. Here we will report our preliminary results on parasite diversity and prevalence in the greater Los Angeles area.

AVIAN COMMUNITY DYNAMICS IN AN URBAN FOREST FRAGMENT IN CENTRAL NEW YORK.

Margaret Valentine, Le Moyne College, Syracuse, NY, valentml@lemoyne.edu; Rachael Miller, Donald McCrimmon Jr., Jason D. Lusci, Le Moyne College, Syracuse, NY.

Urban forest fragments supply important refugia for both migratory and residential wildlife. Anthropogenic variables (e.g., noise pollution, human use, etc.) likely impact the diversity and abundance of wildlife using these fragments. We surveyed birds inhabiting a 12.7-hectare forest on the Le Moyne College campus in Syracuse, NY. This fragment is a multi-use property

for student athletics, research, community members, etc. During the 2018 breeding season, we surveyed 10 points systematically placed throughout the forest. We gathered distance data for estimating imperfect detectability. We are quantifying vegetational characteristics and noise pollution at each point. We hypothesize that bird diversity may not be evenly distributed throughout this fragment, with highest diversity in regions of the forest with minimal influence of anthropogenic activity. We detected 28 species (17 neotropical migrants and 11 residents). Preliminary results from a non-metric multidimensional scaling analysis indicates that 20 species appear to be localized around a few points, while 8 species appear to be evenly dispersed about the fragment. Further analyses will reveal variations in habitat factors that may help to describe these patterns. This information is useful for informing future management programs for this property.

EFFECTS OF MAMMALIAN APOSEMATIC PATTERN AND CONTRAST VARIATION ON PREDATOR AVOIDANCE LEARNING.

Kathy Vo, California State University, Long Beach, kvokathy@gmail.com; Theodore Stankowich, California State University, Long Beach.

Aposematic coloration makes prey defenses easier for predators to learn and remember, reducing mistaken attacks. Coyotes (*Canis latrans*) are potential predators of the striped skunk (*Mephitis mephitis*) but are highly vulnerable to the latter's noxious defenses. To determine how contrast intensity and pattern structure influence avoidance learning in canid predators, we have installed camera traps along transects in local wetland and forested environments to observe wild coyote avoidance behavior in response to artificial prey models that vary in color contrast intensity and pattern structure. Differences in the latency to approach/interact with the models will be compared with respect to the contrast intensity and pattern structure of the model. Past research shows that captive coyotes can easily learn to avoid attacking black and white prey models and can generalize this avoidance to models with more white (high contrast) but not to models with more black (low or no contrast). Preliminary findings suggest that coyote subjects demonstrate greater latency to attack all black and white (maximum contrast) models, regardless of pattern structure, compared to the black and gray (minimal contrast) model.

IDENTIFYING SPATIAL PATTERNS OF GENE FLOW IN BLAINVILLE'S HORNED LIZARD (PHRYNOSOMA BLAINVILLII) IN AN URBAN LANDSCAPE.

Sarah M. Wenner, California State University, Northridge, sarah.wenner.299@my.csun.edu; Jeanne M. Robertson, Katy S. Delaney.

Urban sprawl and the resulting habitat loss and fragmentation have detrimental effects on genetic diversity and connectivity of populations. In low-ranging species with high habitat specificity, natural barriers to gene flow compound these anthropogenic barriers. My study will use principles of landscape genetics to examine populations of Blainville's horned lizards (*Phrynosoma blainvillii*) in the greater Los Angeles area. This region encompasses a putative contact zone between two evolutionary clades. If there is evidence of genomic introgression, it may be considered a genetic hot spot and a priority for future conservation work. I will use RADseq to generate a large dataset of SNPs to approximate effective population size, quantify

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genetic diversity, and estimate population structure. I will examine my genomic data in the context of a Habitat Suitability Analysis performed in the Santa Monica Mountains to infer patterns of fine-scale gene flow across the landscape. I will also determine the extent of introgression between populations of the two evolutionary clades at the putative contact zone. Together, these analyses can be used to determine management strategies for populations of Blainville's horned lizards in this urbanized region.

EFFECTS OF LIGHT POLLUTION ON POPULATIONS OF GRAY TREEFROGS AND GREEN FROGS IN SYRACUSE, NY.

Kylee B. Wilson, Le Moyne College, Syracuse, NY, wilsonkb@lemoyne.edu; Jason D. Lusnier, Le Moyne College, Syracuse, NY.

Urban light pollution represents a non-physical barrier that some nocturnally active wildlife cannot cross, effectively fragmenting their landscape. Wildlife may be attracted to well-lit areas for ease of finding food or detecting predators, while others may avoid urban light because it inhibits their foraging abilities, vision, and dispersal activities. Global amphibian populations are plummeting, so it is critical to understand their response to anthropogenic factors like light pollution for future management. We surveyed presence/absence of gray treefrogs (*Hyla versicolor*) and green frogs (*Lithobates clamitans*) at 26 randomly selected locations stratified for level of urbanization and wetland proximity. We recorded light at each survey location, and are evaluating models incorporating amount of wetland habitat and percentage gray space within a 60 m² radius. We used program PRESENCE to estimate occupancy and habitat use for each species. Overall occupancy (SE) was 0.30 (0.13) for gray treefrogs and 0.26 (0.10) for green frogs. Occupancy for both species was higher in darker areas. Treefrog occupancy ranged from 0.36 (0.14) in total darkness to <0.01(0.02) at 2.47 W/m² light. Green frog occupancy was 0.45 (0.16) in total darkness and no individuals were detected at locations brighter than 0.03 W/m². Our preliminary results suggest that urban light pollution has a negative impact on the occupancy of both species. These preliminary results in conjunction with habitat suitability models will supply useful information for amphibian conservation in Syracuse.

REVIEWING THE PAST, PRESENT AND POTENTIAL LIZARD FAUNAE OF NEW ZEALAND CITIES.

Christopher Woolley, Victoria University of Wellington, chris.woolley@vuw.ac.nz; Stephen Hartley, Victoria University of Wellington; Danielle Shanahan, Zealandia; Nicola Nelson, Victoria University of Wellington.

Cities and urban processes typically have a negative impact on biodiversity via land cover change, high rates of disturbance and high densities of pest species. Increasingly, however, people are being encouraged and empowered to reduce these impacts through urban restoration and backyard conservation initiatives. Internationally, lizards are a common feature of urban biodiversity, but in New Zealand where many species are threatened, little is known about urban populations of native skinks and geckos. To explore the potential of cities for

the conservation of lizards, we collated knowledge about the current lizard faunae of six New Zealand cities and developed a list of species that would have been present in the regions of these cities prior to human settlement. Comparing the two, we found that, although each of the cities has at least one currently urban-dwelling species, the diversity of lizards in all of the cities has declined dramatically since human colonisation. Patterns of species loss in cities reflect those observed across New Zealand more generally, that is, the loss of large-bodied skinks and geckos, probably resulting from predation by introduced mammalian predators, as well as the loss of regionally endemic species. The diversity of species that are currently, or were historically, present in the regions of New Zealand cities means that urban restoration or reconciliation involving recovery or reintroduction of populations could have significant benefits for lizard conservation and advocacy.

**History of the
INTERNATIONAL URBAN WILDLIFE CONFERENCE**

2009 – Amherst, MA

Urban Wildlife Ecology and Management: International Symposium on Urban Wildlife and the Environment
Local Hosts: Massachusetts Division of Fisheries and Wildlife, Massachusetts Department of Conservation and Recreation, University of Massachusetts Amherst, and USGS Massachusetts Cooperative Research Unit

2011 – Austin, TX

Urban Wildlife Management and Planning Conference
Local Hosts: Texas Parks and Wildlife
UWWG Chair: Christopher Moorman, North Carolina State University
Program Chair: Richard Heilbrun

2015 – Chicago, IL

International Urban Wildlife Conference
Local Hosts: Urban Wildlife Institute, Lincoln Park Zoo
UWWG Chair: Robert McCleery, University of FL
Program Chair: Stan Gehrt, The Ohio State University

2017 – San Diego, CA

International Urban Wildlife Conference
Local Hosts: San Diego State University, Santa Monica Mountains National Recreation Area, USGS, US Navy, AECOM, California DOW, San Diego Zoo
UWWG Chair: Nils Peterson, North Carolina State University
Program Chair: Robert McCleery, University of Florida

2019 – Portland, OR

International Urban Wildlife Conference
Local Hosts: Samara Group, Portland State University
UWWG Chair: Liza Lehrer, Urban Wildlife Institute, Lincoln Park Zoo
Program Chair: Nils Peterson, North Carolina State University