FINAL PROGRAM
47th Annual Meeting and Symposium
Virtual
February 15, 17, 18, 22, 24, and 25, 2022
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Requirements for Speakers and Presentations

The Desert Tortoise Council does not permit inappropriate images as part of presentations in the program or as any part of symposia. Inappropriate photos include, but are not limited to: vulgar, lewd, or suggestive images of people; people in awkward positions or scanty attire; and people engaged in personal and private activities. The Desert Tortoise Council expects all participants and speakers to maintain a high level of professionalism.

Guidelines for Asking and Answering Questions at the Symposium

Several years ago, several attendees approached members of the Board of Directors with concerns about the tone of questions to speakers. The concerned parties included members of the audience as well as speakers. Some members of the audience noted that some questioners appeared to be vitriolic and angry; some questioners used the opportunities at the microphone to present their views in long winded soliloquies rather than to ask questions. Furthermore, some speakers were irritated with the questions asked of them. To avoid a similar occurrence at future meetings, the Board of Directors developed guidelines for asking and answering questions at Symposia. These guidelines offer an opportunity to review the purpose for holding annual symposia and to reiterate our long-standing policy of professionalism and civility to all participants.

The Desert Tortoise Council promotes conservation of the desert tortoise in a variety of ways, including annual symposia. One purpose of the Symposia is to bring together scientists, wildlife biologists, managers, representatives of non-government organizations, and other interested parties to share the latest information on tortoises and their management. The speakers vary in their interests and areas of expertise, as well as in experience in giving presentations. Some speakers are giving their very first public presentations; others have presented hundreds of lectures and power point programs. All are welcome. The symposium is a learning experience and learning is facilitated by respect and courtesy. All speakers should receive courteous and professional treatment and, in turn, all speakers should treat the audience with respect. By following the simple guidelines outlined above, the Board hopes to have a collegial atmosphere and productive meeting.

To assist with the policy of professional and civil behavior, the Board requests that questioners follow the guidelines listed below:

1. Ask one question at a time. If you have two questions, do not ask both at once. Allow the speaker to answer the first question before proceeding to the second question.

2. If more than one person is waiting to ask, then ask only one question.

3. All questions are legitimate. However, the way the question is framed is usually the issue. Each question can be framed in a professional and courteous manner. Speakers, too, can draw on the following guidelines when answering questions.

4. Speakers should consider that all questions are legitimate and fair. However, some may be poorly worded because the questioner may not fully understand the subject or may need some assistance in framing the question in a professional manner. The speaker may need to clarify the question and should then repeat the question to the audience so that the audience will hear it clearly.
5. Some questions are not easily answered for a variety of reasons: no data, insufficient data, topic cannot be discussed because court proceedings are underway, etc. The speakers should state why the question cannot be answered or can only be addressed in part. The speaker may need to think at length about an appropriate answer and, in such cases, may need to say just that. The speaker may refer the questioner to the email in the Abstracts.
PROGRAM

47th ANNUAL DESERT TORTOISE COUNCIL SYMPOSIUM (Virtual)
Held the mornings of February 15th, 17th, 22nd, and 24th and afternoons of the 18th and 25th, 2022
All sessions and presentations are in Pacific Standard Time

Note: Speakers are the first person noted for each presentation unless *denotes otherwise
Raffles and announcements shall be held at the end of each break and day

FEBRUARY 15, 2022, TUESDAY

8:00 a.m.  Introduction of Meeting Chairs and Opening Remarks
Ed LaRue and Michael Vamstad: Members, Board of Directors of the Desert Tortoise Council, Palmdale, CA and Chairs of the Symposium

8:15 a.m.  The year in review
Ken MacDonald, Chair, Desert Tortoise Council, and NewFields, Las Vegas, NV

Session 1. An Overview of Climate Change and Effects in North America

8:30 a.m.  Keynote and Plenary Address: Jonathan T. Overpeck
Climate change and the aridification of North America
Jonathan T. Overpeck: Samuel A. Graham Dean of the School for Environment and Sustainability, University of Michigan, Ann Arbor

9:00 a.m. Questions for the speaker and discussion

Session 2. Progress and Thoughts on Managing Predation by the Common Raven on Desert Tortoises.
Session arranged by Kerry Holcomb

Seth Harju1, Peter Coates2, Seth Dettenmaier2, Jonathan Dinkins3, and Pat Jackson4: 1Heron Ecological, LLC, Kingston, ID; 2U.S. Geological Survey, Dixon, CA; 3Oregon State University, Corvallis; and 4Nevada Department of Wildlife, Reno

9:30 a.m.  A desert tortoise-common raven viable conflict threshold: A generalizable approach to corvid depredation management
Kerry L. Holcomb1, Peter S. Coates2, Brian G. Prochazka2, Timothy Shields3; William I. Boarman4: 1U.S. Fish and Wildlife Service, Palm Springs, CA; 2U.S. Geological Survey, Dixon, CA; and 4Hardshell Labs, Inc., Haines, AK

9:45 a.m.  The Techno-Tort™: An active predator aversion training device
William I. Boarman1, Tim Shields4, and Mark Cridge5: 1Hardshell Labs, Inc., Joshua Tree, CA; 4Cornerstone Research Group, Miamisburg, OH

10:00 a.m.  Break
10:15 a.m.  Common raven subsidy denial via laser  
*Tim Shields¹ and William I. Boarman²*: Hardshell Labs, Inc., ¹Joshua Tree, CA, and ²Spring Valley, CA

10:30 a.m.  Identifying population management strategies for avian predators: A decision tool  
*Andrea Currylow¹, Brenda Hanley², Kerry Holcomb³, Timothy Shields⁴, Stephen Boland⁵, William Boarman⁶, and Mercy Vaughn⁷*: ¹U.S. Geological Survey, Homestead, FL, and University of North Carolina, Wilmington; ²Cornell University, Ithaca, NY; ³U.S. Fish and Wildlife Service, Palm Springs, CA; ⁴Hardshell Labs, Inc., Haines, AK; and ⁷Sundance Biology Inc., Paso Robles, CA

10:45 a.m.  A citizen science raven research project: Raven nest mapping  
*Tim Shields¹ and Erin Eichenberg²*: Hardshell Labs, Inc., ¹Joshua Tree, CA; and ²Boulder City, NV

11:00 a.m.  Efficacy of common raven (*Corvus corax*) reproduction manipulations at conserving sensitive prey species: Three case studies  
*Corina Sanchez¹, B. Brussee¹, P. Coates¹, K. Holcomb², S. Harju³, T. Shields⁴, M. Vaughn⁵, B. Prochazka⁶, S. Mathews⁷, S. Cornell⁸, C. Olson⁹, D. Delehanty¹⁰*: ¹U.S. Geological Survey, Dixon, CA; ²U.S. Fish and Wildlife Service, Palm Springs, CA; ³HWA Wildlife Consulting, Laramie, WY; ⁴Hardshell Labs, Inc., Haines, AK; ⁵Sundance Biology, Inc., Paso Robles, CA; ⁶Meeteetse Conservation District, WY; ⁷Idaho State University, Pocatello

11:15 a.m.  Questions for the panel and discussion

11:30 a.m.  Annual Meeting of the Desert Tortoise Council  
*Ken MacDonald*: Chair, Board of Directors, Desert Tortoise Council, Palmdale, CA

12:30 p.m.  Announcements and adjourn for the day

February 17, 2022, Thursday

8:15 a.m.  Announcements, Introduction the Session and Dr. Smerdon  
*Ed LaRue*: Meeting Chair and Member, Board of Directors, Desert Tortoise Council, Palmdale, CA

Session 3. Climate Change: The Contributions from Anthropogenic Warming

8:30 a.m.  Plenary Address: Jason Smerdon  
*Large contribution from anthropogenic warming to an emerging North American megadrought*  
*Jason Smerdon*: Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY.

9:00 a.m.  Questions for the speaker and discussion
9:15 a.m. Did more female than male Agassiz’s desert tortoises die in the western Sonoran Desert during California’s epic 2012-2016 drought? 
Jeffrey E. Lovich1, S.R. Puffer1, K. Cummings1, T.R. Arundel1, M.S. Vamstad2, and K.D. Brundige3: 1U.S. Geological Survey, Flagstaff, AZ; 2Joshua Tree National Park, Twentynine Palms, CA; 3Coachella Valley Conservation Commission, Palm Desert, CA

9:30 a.m. Mojave Desert grasslands: 40 years of collecting historical ecological evidence of past and present native plant community diversity 
Laura Cunningham: California Director, Western Watersheds Project, Beatty, NV

9:45 a.m. Restoration of desert tortoise habitat: Indicators, techniques, effectiveness, and costs 
Scott R. Abella1 and Stefanie Ferrazzano2: 1Natural Resource Conservation LLC, Boulder City, NV, and University of Nevada, Las Vegas; and 2Clark County Department of Environment and Sustainability, NV

10:00 a.m. Questions for the panel and discussion

10:15 a.m. Break

Session 4. Genomics and Genetics Scaled to Genus, Species, and Region

10:30 a.m. Genomic insights into the evolution and conservation of threatened Gopherus tortoise species 
Kenro Kusumi1, Greer A. Dolby1, Sarah Baty1, Dale F. DeNardo1, Paul Crump2, Shawn F. McCracken3: 1Arizona State University, Tempe, AZ; 2Texas Parks and Wildlife Department, Austin TX; and 3Texas A&M University-Corpus Christi, TX

10:45 a.m. Understanding the adaptive potential between different regions of the range for the Mojave desert tortoise (Student Paper) 
Anjana Parandhaman1, N. Byer1, M.D. Matocq1, T. Dilts1, S. Wright1, D. Friend1, D.P. Boyle1, S.D. Bassett1, A.G. Vandergast2, T.C. Esque2, J.S. Heaton1, and K.E. Nussear1: 1University of Nevada, Reno; and U.S. Geological Survey, 2San Diego, CA and 3Henderson, NV

11:00 a.m. Reconciling genetic and field estimates of dispersal and gene flow in the Mojave desert tortoise 
Nathan W. Byer1, A. Parandhaman1, S. Hromada1, S. Bassett1, D. Boyle1, T. Esque2, A. Vandergast2, T. Dilts1, K. Nussear1, J. Heaton1, M. Matocq1: 1University of Nevada, Reno, NV; and U.S. Geological Survey, 2Boulder City, NV 3San Diego, CA

11:15 a.m. Questions for the panel and discussion
Session 5. Monitoring Sonoran Desert Tortoises

11:30 a.m. Monitoring results from Pima County’s 2021 Sonoran desert tortoise campaign
Amanda Webb, Ian Murray, and Sami Hammer: Pima Count Office of Sustainability and Conservation, Tucson, AZ

11:45 a.m. Questions for the speaker and discussion

12:00 Noon Announcements and adjourn for the day

February 18, 2022, Friday

1:45 p.m. Announcements, Introduction of the Session and Dr. Stahle
Ed LaRue: Meeting Chair and Member, Board of Directors, Desert Tortoise Council, Palmdale, CA

Session 6. Assessing Climate Change and Frequency of Droughts Using Tree Rings

2:00 p.m. Plenary Address: David W. Stahle
The tree-ring record of North American drought and pluvial, including the precipitation reconstructions for southeastern California over the past 600 years
David W. Stahle: University of Arkansas, Fayetteville

2:30 p.m. Questions for the speaker and discussion

Session 7. Movements and Connectivity in Tortoise Populations in the Mojave and Sonora Deserts

2:45 p.m. Evaluating connectivity model predictions using Sonoran desert tortoise movements (Student Paper)
Sean Sutor, Nancy E. McIntyre, and Kerry Griffis-Kyle: Texas Tech University, Lubbock, TX

3:00 p.m. Movement of Mojave desert tortoises is altered by landscape and small-scale disturbances (Student Paper)
Steven J. Hromada¹, Todd C. Esque², Amy G. Vandergast³, K. Kristina Drake², and Kenneth E. Nussear¹: ¹University of Nevada, Reno; U.S. Geological Survey, ²Boulder City, NV and ³San Diego, CA

3:15 p.m. Questions for the speakers and discussion

3:30 p.m. Break

Session 8. Desert Apocalypse: A Film about Solar Development in Deserts

3:45 p.m. Desert Apocalypse: A series about the assault on desert habitats
Justin McAffee¹, Kevin Emmerich², and Laura Cunningham³: ¹Independent Filmmaker, and ²Co-founders, Basin and Range Watch, Beatty, NV

4:15 p.m. Questions and discussion
Session 9. The U.S. Fish and Wildlife Service Issues a Decision that Federal Listing of the Sonoran Desert Tortoise is not Warranted

4:30 p.m. A quick synopsis of the finding by the U.S. Fish and Wildlife Service for the Sonoran Desert Tortoise
Ed LaRue: Chair, Ecosystems Advisory Committee, Desert Tortoise Council, Palmdale, CA

4:40 p.m. A critique of and concerns about the U.S. Fish and Wildlife Service’s determination that the Sonoran Desert Tortoise does not warrant the protection of the Endangered Species Act
Cyndi Tuell: Arizona and New Mexico Director at Western Watersheds Project

4:55 p.m. Questions for the speakers and discussion

5:10 p.m. Adjourn for the day

February 22, 2022, Tuesday

8:15 a.m. Announcements, Introduction of the Session and Dr. Bertolero
Ed LaRue: Meeting Chair and Member, Board of Directors, Desert Tortoise Council, Palmdale, CA

Session 10. Translocations and Headstarting of Tortoises in the United States and Europe

Plenary Speaker: Albert Bertolero

8:30 a.m. Chelonian translocations in Catalonia: A 30-year overview
Albert Bertolero: Associació Ornitològica Picampall de les Terres de l’Ebre, Catalonia, Spain

9:00 a.m. Questions for the speaker and discussion

9:15 a.m. Desert tortoise translocation of the Marine Corps Air Ground Combat Center (Combat Center) in 2021
Brian T. Henen: Marine Corps air Ground Combat Center, Twentynine Palms, CA

9:30 a.m. A comparison of the post-release survival and behavior of indoor-reared and combination-reared head-started Mojave desert tortoises (Gopherus agassizii) (Student Paper)
Susanna Mann¹, Brian Todd², Kurt Buhlmann¹, Clark Rushing¹, Tracey D. Tuberville¹; ¹University of Georgia, Aiken, SC; and ²University of California, Davis, CA

9:45 a.m. Importance of age and microsite on habitat selection and space use in headstarted juvenile Mojave desert tortoises
Melissa J. Merrick, Talisin T. Hammond, and Ronald R. Swaisgood: San Diego Zoo Wildlife Alliance, Escondido, CA

10:00 a.m. Break
10:15 a.m. **Multi-year space-use and survival of head-started Mojave desert tortoises following release in Mojave National Preserve, California, USA (Student Paper)**
Collin Richter¹, ², Michel Kohl², Pearson A. McGovern¹, ², Carmen M. Candal¹, ², Kurt A. Buhlmann¹, Brian D. Todd³, and Tracey D. Tuberville¹, ²: ¹Savannah River Ecology Laboratory, University of Georgia, Aiken, SC; ²University of Georgia, Athens, GA; and ³University of California, Davis, CA

10:30 a.m. **Innate testosterone identifies sex of hatchling Mojave desert tortoises (Gopherus agassizii) (Student Paper)**
M. A. Walden¹, K. J. Loope²,³, E.A. Hunter⁴, S.J. Divers⁵, J.R. Comolli⁵, T.C. Esque⁶, K. T. Shoemaker¹: ¹University of Nevada, Reno, NV; ²Georgia Southern University, Statesboro, GA; ³Virginia Tech, Blacksburg, VA; ⁴U.S. Geological Survey Blacksburg, VA; ⁵University of Georgia, Athens, GA; and ⁶U.S. Geological Survey, Boulder City, NV

10:45 a.m. Questions for the panel and discussion

Session 11. Equipment and Methods to Enhance Surveys for Tortoises, A Paper and Posters

11:00 a.m. **AI-assisted drone surveys detect desert tortoises and soil burrows at rates comparable to human observers**
Matthew S. Bandy¹, Cameron Rognan², and Michael W. Tuma³: ¹Resi Solutions, Albuquerque, NM; ²Washington County HCP, St. George, UT; and ³Resi Solutions

11:15 a.m. Posters: Questions and discussion

**BurrowFinder: Increasing survey efficiency with offline imagery processing and machine learning**
Timothy J. Divoll¹, Ohad Nir¹, and William T. Whitehead²: SWCA Environmental Consultants, ¹Phoenix, AZ and ²Albuquerque, NM

**Detecting desert tortoises in highway culverts with wildlife cameras and machine learning**
Timothy J. Divoll and Ohad Nir: SWCA Environmental Consultants, Phoenix, AZ

Session 12. The Role of Climate in Human Migrations

11:30 a.m. **Plenary Address**
**Acting on Internal Climate Migration: Findings from the latest Groundswell Report**
Viviane Clement, Senior Climate Change Specialist: Word Bank Group, Washington, DC

11:50 a.m. Questions and discussion

12:00 Noon Announcements and adjourn for the day
**February 24, 2022, Thursday**

8:15 a.m.  **Announcements and Introduction of the Session and Dr. Kuchling**  
*Ed LaRue: Meeting Chair and Member, Board of Directors, Desert Tortoise Council, Palmdale, CA*

**Session 13. New and Exciting Report on Viviparity in a Turtle Species**

8:30 a.m. **INVITED and FEATURED SPEAKER**  
**Discovery of a new reproductive strategy for the Order Testudines: Beating the heat through facultative viviparity in the south African tortoise *Chersina angulata***  
*Gerald Kuchling¹ and Margaretha Delina Hofmeyr²†*: ¹The University of Western Australia, Crawley, Western Australia, Australia; and ²University of the Western Cape, Bellville, South Africa. †Deceased

8:55 a.m. Questions of the speaker and discussion

**Session 14. Legal and Conservation Actions Directed to Recovery of Tortoises**

9:10 a.m. **Advancing tortoise protection and recovery across the country**  
*Lisa Belenky¹, Patrick Donnelly², and Ileene Anderson³*: Center for Biological Diversity, ¹Oakland, CA, ²Las Vegas, NV, and ³Los Angeles, CA

9:30 a.m. **The Desert Tortoise Recovery Office: A 17-year review**  

9:45 a.m. **U.S. Fish and Wildlife Service Update on Desert Tortoise Recovery Activities**  
*Garrett Sisson*: Utah Ecological Service Field Office, U.S. Fish and Wildlife Service, West Valley City, Utah

10:00 a.m. Break

10:15 a.m. **Recovery Progress at Mojave National Preserve**  
*Michael Burchett, Neal Darby, Debra Hughson, and Mike Gauthier*: Mojave National Preserve, Barstow, CA

10:30 a.m. **Clark County Multiple Species Habitat Conservation Plan Update**  
*Scott Cambrin*: Clark County Desert Conservation Program, Las Vegas, NV

10:45 a.m. **Desert Tortoise Management and Research in Joshua Tree National Park**  
*Michael S. Vamstad*: Joshua Tree National Park, Twentynine Palms, CA

11:00 a.m. Questions and panel discussion

11:20 a.m. **Announcements: Winners of the Photography Contest**  
*Maggie Fusari*: Chair, Photography Awards, Desert Tortoise Council, Palmdale, CA
11:45 a.m. **Announcements: Student Award Winners**  
*Michael W. Tuma: Chair, Student Awards, Desert Tortoise Council, Palmdale, CA*

11:55 a.m. **Announcement of the Winner of the David J. Morafka Memorial Research Award**  
*Michael W. Tuma: Chair, Grants and Awards Committee, Desert Tortoise Council, Palmdale, CA*

12:00 p.m. Adjourn for the day

**February 25, 2022, Friday afternoon**

12:45 p.m. **Announcements and Introduction to the Session by Dr. Esque**  
*Ed LaRue¹ and Todd Esque²: ¹Meeting Chair and Member, Board of Directors, Desert Tortoise Council, Palmdale, CA; ²U.S. Geological Survey, Boulder City, NV*

Session 15. Roads—Dirt and Paved—Off-highway Vehicle Tracks, Trails, and Proliferation

1:00 p.m. **Challenges facing route restoration in the West Mojave**  
*Ed LaRue: Desert Tortoise Council, Palmdale, CA*

1:15 p.m. **Road density and Mojave desert tortoise population trends**  

1:30 p.m. **OHV restoration: Factors of success**  
*Randy Banis: Friends of Jawbone, Leona Valley, CA*

1:45 p.m. **Monitoring restoration effectiveness in the Fremont-Kramer Desert Wildlife Management Area**  
*Sam Easley and Sarah Berryman: Transition Habitat Conservancy, Piñon Hills, CA*

2:00 p.m. **Challenges and opportunities managing private mitigation lands in the California deserts**  
*Jacob Robinson: Wildlands, Rocklin, CA*

2:15 p.m. **Habitat acquisition considerations and OHV management challenges for conservation organizations in the California desert**  
*Cody Hanford: Mojave Desert Land Trust, Joshua Tree, CA*

2:30 p.m. Break

2:45 p.m. **Route proliferation challenges at the urban interface in the eastern Mojave**  
*Lara A. Kobelt, Jonathan P. Smith, and Jimmy O. Linares: Bureau of Land Management, Las Vegas, NV*
3:00 p.m.   Evaluating use of restored unauthorized incursions on BLM lands in California's Mojave Desert  

3:15 p.m.   A challenge of managing desert tortoise conservation–unauthorized motorized travel  
Amy L. Fesnock: California Desert District, Bureau of Land Management, Sacramento, CA

3:30 p.m.   Fences and barriers work for managing unauthorized uses: A valuable tool  
Kristin H. Berry¹ and Ann McLuckie²: ¹U.S. Geological Survey, Reno, NV; and ²Utah Division of Wildlife Resources, Hurricane, UT

3:45 p.m.   Questions and panel discussion

4:15 p.m.   Announcements: Winners of the Annual Awards of the Desert Tortoise Council  
Kristin Berry: Chair, Awards Committee, Desert Tortoise Council, Palmdale, CA

4:40 p.m.   Closing Remarks  
Ed LaRue¹ and Mari Quillman²: ¹Meeting Chair and ²Host Chair, Desert Tortoise Council, Palmdale, CA

5:00 p.m.   Adjourn the Symposium

Nonprofit Partner Organizations

Center for Biological Diversity. Ileene Anderson, 660 S Figueroa St, Suite 1000, Los Angeles CA 90017, Phone: (323) 490-0223. Website: www.biologicaldiversity.org. Email: ianderson@biologicaldiversity.org

Desert Tortoise Preserve Committee. Sophia Osho, Executive Administrator, P.O. Box 940, Ridgecrest, CA 93556. Phone (442)294-4258. Website: www.tortoise-tracks.org, Email: dtpc@tortoise-tracks.org

The Living Desert Zoo and Gardens. Alex Ocanas, James Canoff-Burg, 47900 Portola AV, Palm Desert CA 92260, Phone: (760) 346-5694, Website www.LivingDesert.org. Email: jdanoffburg@livingdesert.org, aocanas@livingdesert.org  
Website: www.natureandculture.org, Email: llozano@natureandculture.org

Tortoise Group. Sarah Mortimer, 2000 East Flamingo, Las Vegas NV 89119. Phone: (702) 739-7113. Website: tortoisegroup1.org. Email: sarahmortimer@tortoisegroup.org

Western Watersheds Project. Laura Cunningham, PO Box 70, Beatty NV 89003, Phone: (775) 513-1280, Website: https://www.westernwatersheds.org. Email: lcunningham@westernwatersheds.org