

**2016 Secretary of Defense Environmental Award
Natural Resources Conservation (Individual/Team)
Dr. Brian T. Henen, Marine Corps Air Ground Combat Center**

Background

Dr. Brian Henen has served as a civilian employee of the U.S. Marine Corps aboard the Marine Corps Air Ground Combat Center (Combat Center) for approximately 10 years. As the base Ecologist (GS-0408-12), he leads natural resource conservation and regulatory compliance activities for federally threatened and endangered species aboard the Combat Center. Dr. Henen has acted as head of the Conservation Branch, including throughout most of 2014-2015.

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The Combat Center encompasses a complex desert mosaic of rugged mountains, bajadas, dry lakes, and ephemeral washes across 705,000 acres in southern San Bernardino County. This fragile ecosystem supports a rich diversity of plants and wildlife, including the federally-threatened Agassiz’s desert tortoise (*Gopherus agassizii*) and at-risk species like desert bighorn sheep (*Ovis canadensis nelsoni*), Mojave fringe-toed lizard (*Uma scoparia*), and crucifixion thorn (*Castela emoryi*). The Combat Center supports service-level Marine Air Ground Task Force (MAGTF) combined-arms training to prepare forces for combat and support the Commandant of the Marine Corps’ responsibilities to national security. The MAGTF Training Command (MAGTFTC) trains up to one-fourth of the Fleet Marine Force (approximately 45,000 Marines) each year via ground combat operations in live-fire, combined arms exercises, and numerous other training exercises aboard the Combat Center. The MAGTFTC also trains foreign forces and over 5,000 Marines annually in the Marine Corps Communication and Electronics School (MCCES). The Combat Center hosts 11,300 active duty military, 8,600 family members, and 2,500 civilian personnel. The large-scale and complex nature of world-class, live-fire training offers challenges and opportunities to conserve the natural resources of the Combat Center.



Dr. Brian T. Henen, Ecologist, Marine Corps Air Ground Combat Center

Position Description

As base Ecologist, Dr. Henen utilizes his expertise to support the Command Center and its conservation programs in a variety of capacities. With knowledge of land and wildlife resource management, he supports the Marine Corps in matters of natural resource and habitat management, as well as land administration and acquisition. Dr. Henen is responsible for designing, coordinating, conducting, analyzing, and validating research to support Marine Corps efforts, and he works both independently and in collaboration with other organizations to yield useful studies, publications, professional/scientific partnerships, and additional ecological programs.

Summary of Accomplishments

Land Expansion

Passage of the National Defense Authorization Act of Fiscal Year 2014 (NDAA) culminated several years of complex, large-scale environmental planning. The NDAA authorized expansion of the Combat Center from 598,000 acres to 705,000 acres of exclusive military-use area to support sustained Marine Expeditionary Brigade (MEB) exercises. The expansion also adds 56,400 acres of Shared-Use Area, the management of which the Combat Center shares with Bureau of Land Management (BLM).

Dr. Henen aggressively leads the natural resource compliance and conservation activities necessary to enable training in the expansion area. This began with his developing a \$50 million desert tortoise translocation program, which includes survey, health assessment, translocation, and continued monitoring for the next 30 years.

Beginning fall 2014, he has overseen the survey of approximately 50,000 acres of land in the expansion area. Over 1,400 desert tortoises have been located, their health assessed, population data recorded, and almost all fitted with radio transmitters preparatory to translocation. Over 180,000 acres of proposed recipient areas and control sites have also been surveyed, with the health of resident tortoises assessed and another 450 fitted with transmitters for later monitoring of resident and control populations. Dr. Henen generated a cost savings of over \$1.5 million through judicious coordination of survey and health assessment efforts when defining protocols for this field work.

A critical part of this program is the specific translocation plan, co-authored by Dr. Henen in



Biologists collect a blood sample as part of desert tortoise health assessments in the land expansion area preparatory to translocation. Disease is a contributing factor to substantial decline in desert tortoise populations, and care is taken to keep levels of disease low in Combat Center populations.

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2015, describing handling methods, translocation sites, follow-on monitoring, and associated research questions. This plan included selection of potential translocation recipient and scientific control sites meeting strict criteria, and rigorous evaluation of tortoise density, health, and predation threats at these sites. He negotiated use of four sites within BLM property near the installation for recipient or control sites. In Spring 2016, prior to the first MEB exercise, over 1,150 desert tortoises will be translocated to these sites, at a rate of approximately 100 tortoises per day to fit within a narrow window of temperature-specific opportunity. Successful execution of

this translocation operation has required defining an individual disposition for each desert tortoise planned for translocation and careful planning and coordination of tortoise location, assessment, transport, and release efforts.

Dr. Henen was also instrumental in establishing a partnership with a private ranching interest, BLM, and U.S. Fish and Wildlife Service (USFWS), allowing translocation of tortoises into a BLM grazing allotment. This provides an important opportunity to study the interactions between livestock grazing and desert tortoise. Much of the desert tortoise recovery efforts are focused on federal land, and outcomes from these studies have the potential to affect federal land use throughout the southwestern deserts. Use of the additional habitat available in the grazing allotment also helps to ensure a successful translocation effort.

Practical Desert Tortoise Conservation

The Mojave Desert population of the Agassiz's desert tortoise (*Gopherus agassizii*) was listed as threatened in 1990. Populations throughout the desert continue to decline, with losses of up to 95% over the past few decades. Habitat fragmentation, subsidized predators (e.g., coyotes and common ravens), and disease have all contributed to this decline.

The Combat Center constructed the four-acre Tortoise Research and Captive Rearing Site (TRACRS) in 2006. Dr. Henen contributed to the design and construction of the facility, and continues to develop, manage, and improve its innovative research and recovery projects.



The Combat Center gives baby tortoises a head start at the Tortoise Research and Captive Rearing Site (TRACRS). Fencing and aviary netting exclude predators (e.g., coyotes and common ravens), which are major contributors to tortoise mortality.

Researchers use ultrasound and x-ray radiography to detect pregnancy in free-ranging female tortoises. Gravid females are brought to the facility to lay their eggs in constructed burrows before being released back into the wild. Side panels, fencing, and aviary netting exclude typical predators of baby and juvenile desert tortoises, including coyotes and common ravens.

Juvenile tortoises are kept in the facility until they have grown sufficiently to avoid raven predation—approximately nine years. Despite several consecutive years of drought, Dr. Henen has maintained 96% survivorship of juvenile desert tortoises in TRACRS as of 2015. This compares favorably to published estimates of 40% survivorship for juveniles in the wild under normal (non-drought) conditions. In addition, a 2015 study demonstrated the facility generates reasonable gender ratios (approximately 1:1 males to females), avoiding a flaw common to captive breeding programs where imbalanced gender ratios are produced.

By design, TRACRS relies on nature as much as possible, providing only small supplements to natural processes. As a result, operational costs for TRACRS are minimized (approximately \$80k per year), and substantially lower than other recovery efforts commonly practiced. Additionally, the head-start program offers tangible benefits by directly increasing numbers in local desert tortoise populations. TRACRS also acts as a natural laboratory, offering opportunities for basic and applied science at low or no additional cost. Indeed, many serendipitous discoveries have already been made at the facility (e.g., tortoise growth rates; data on shell hardening).



Col Harp, Combat Center Chief of Staff, releases a member of the first cohort of tortoises to be raised in the TRACRS facility. Juvenile tortoises are kept in the facility until they have grown sufficiently to avoid raven predation—about nine years.

In September 2015, Dr. Henen coordinated release into the wild of the first cohort of captive-reared juvenile tortoises from TRACRS. The release marks a major transition from simply rearing young to actively enhancing tortoise populations. Juveniles were fitted with radio transmitters prior to release to facilitate future monitoring and research. The release event garnered positive attention from national print, radio, and television media, with publications such as the Wall Street Journal carrying a positive story about desert tortoise conservation at the Combat Center.

The desert tortoise release garnered positive attention from national print, radio, and television media.

In addition to generating substantial goodwill with regulatory agencies, Dr. Henen's research at TRACRS directly supports the MAGTFTC mission. Approximately 250 juvenile tortoises found during clearance surveys of the expansion area have been temporarily housed at TRACRS, with survivorship rates exceeding 99%. These juveniles are too small to have radio transmitters affixed, and will be protected until they grow large enough to safely release into the translocation sites. TRACRS also offers special pens to sequester tortoises showing symptoms of respiratory disease, keeping infection rates low amongst Combat Center populations.

Research, Education, and Outreach

Dr. Henen coordinates a vigorous desert tortoise outreach program, educating lay people, natural resource management practitioners, and the scientific community. He commonly accompanies our captive desert tortoise ambassadors at on-base community outreach events such as the 2015 Earth Week Extravaganza and provides tours to on-base groups (e.g., Officer Spouse's Club) or visiting dignitaries. Dr. Henen also actively represents the Combat Center off-base, such as at several local, annual community celebrations, child education events in local schools, and at the

King of Hammers off-road racing event, where he promotes desert tortoise awareness. In 2014 Dr. Henen also sponsored an Eagle Scout project aboard the installation, where the Scout developed, erected, and publicized permanent tortoise awareness signs at high-traffic ingress points and intersections on the installation. In 2015 he sponsored the capstone video project for a Master's student at University of California, Irvine, demonstrating the conservation efforts at the Combat Center.



The Combat Center's tortoise ambassadors are a popular sight at installation and community events. Dr. Henen coordinates an active outreach program educating Marines, families, and the local community about desert tortoise conservation.

In February 2015, Dr. Henen hosted the Desert Managers Group (DMG) semi-annual meeting. The DMG is an inter-agency forum for federal, state, and local government agencies to address and discuss desert land-use issues of common concern. At that meeting he briefed agency and government representatives on Combat Center expansion plans and associated desert tortoise survey and translocation. He also shares ideas and results (successes and failures) with other desert tortoise conservation programs, especially with the Mojave National Preserve program modeled directly on TRACRS.

During the reporting period, Dr. Henen was primary author on several manuscripts, including two peer-reviewed articles for scientific journals and more casual bulletin or newsletter articles. He wrote a Fall 2014 USMC Conservation Newsletter article describing desert tortoise conservation and research activities conducted by the Combat Center, and how they are critical to conserving the species. In 2015 the U.S. Fish and Wildlife Service published in its *Endangered Species Bulletin* Dr. Henen's article describing the Combat Center's programmatic approach to regulatory consultation, how this comprehensively addresses both the training mission and the most critical desert tortoise conservation needs, and how the approach allows both agencies to focus resources more efficiently. He co-authored desert tortoise landscape genetics and head start presentations at the Desert Tortoise Council Symposium, helping promote tortoise conservation and MCAGCC's commitment to tortoise conservation while sustaining the training mission.

Dr. Henen collaborated with independent and University of California, Riverside researchers to develop a tortoise habitat model from 11 environmental variables (e.g., summer temperature, soil composition and topographic ruggedness, slope and aspect). The article he co-authored was accepted for publication in a peer-reviewed, scientific journal (*Chelonian Conservation and Biology*). This study identifies habitat shifts associated with 1° C and 3° C increases in temperature anticipated for this region under climate change modeling. However, the paper also identifies refugia at the Combat Center where populations may persist despite climate change effects, suggesting near-term management efforts necessary to ensure long-term persistence of the species. This research is an example of the cost-efficient resource management practiced by Dr. Henen—research results were used both to identify immediate survey locations for land-expansion translocation efforts, and to identify implications from climate change. The research results also serve as a launching point for modeling habitat of multiple sensitive species aboard the installation, and for analyzing effects of habitat disturbance on these species.

His research identifies refugia at the Combat Center where desert tortoise populations may persist despite climate change.

Dr. Henen has several other manuscripts in preparation describing the results of his research aboard the Combat Center. For example, in partnership with the University of California, Los Angeles, Dr. Henen has submitted for peer review a manuscript describing the findings of his gender ratio research at TRACRS. In another example of cost-efficient, multi-purpose research, this manuscript both validates the TRACRS captive breeding model and show how climate change effects may threaten population viability by skewing gender ratios.

Other Mission Support

Dr. Henen is a dedicated member of the Combat Center staff, keeping mission execution as his central focus. For example, in 2014 he successfully negotiated concurrence by the U.S. Fish and Wildlife Service for convoy operations in the expansion area, despite the Combat Center not yet having implemented critical elements of the biological opinion associated with the land expansion. This allowed approximately 6,000 person-days of convoy training in 2015, and established an early U.S. Marine Corps presence in the expansion area. He similarly negotiated shifting a resource-based restricted area from the expansion lands to a more remote corner of the Combat Center less useful for training. This configuration is more conducive to



Dr. Henen has partnered with UCLA, represented by Dr. Ken Nagy (left), for desert tortoise conservation research. Mr. Brian Croft, Acting Division Chief, USFWS (center) looks on during an explanation of innovative desert tortoise recovery efforts aboard the Combat Center.

unfettered MEB exercises in the expansion area, and affords natural, terrain-based protection to the restricted area. Dr. Henen was also part of the interagency team that developed the plan for joint management of the shared-use area.

Dr. Henen has lent his considerable expertise to the larger DoD mission in the desert Southwest.

He has also supported three environmental assessments at the Combat Center during the reporting period. By re-purposing existing survey data and applying expert knowledge of the natural resources aboard the installation, Dr. Henen was able to reduce environmental overhead on these planning efforts. This expedited planning for the upgrade of electrical infrastructure around Camp Wilson, installation of a photovoltaic field, and substantial expansion of rotary- and tilt-rotor landing areas aboard the Combat Center.

Dr. Henen has likewise lent his considerable expertise to aid the larger Department of Defense mission in the desert Southwest. He has worked with Marine Corps Logistics Base, Barstow on desert tortoise issues related to an ongoing environmental assessment for training at that installation, provided input into survey design and tortoise density calculations at Marine Corps Air Station, Yuma, and consulted with the U.S. Army's Ft Irwin on survey and translocation. This mirrors past work with Ft Irwin and the U.S. Air Force's Edwards Air Force Base.