



2019 Secretary of the Navy Environmental Awards Natural Resources Conservation, Large Installation Marine Corps Air Ground Combat Center

INTRODUCTION

The mission of the Marine Air Ground Task Force Training Command (MAGTFTC) is to manage the Marine Air Ground Task Force Training Program and conduct service level Marine Air Ground Task Force combined arms training to enhance the combat readiness of operating forces and support the Marine Corps’ responsibilities to national security.

CONTENTS

Introduction	1
Natural Resources.....	1
Partnerships	2
Way Forward.....	7

This mission is implemented at the Combat Center by providing a standard of excellence in managing facilities, services, and support to the operating forces and their families to ensure readiness of the tenant and resident commands aboard the Combat Center.

INSTALLATION

The Combat Center is the largest contiguous Marine Corps installation in the world at over 1,100 square miles, 99% of which are undeveloped range and training areas. The

installation hosts approximately 11,300 active duty military, 8,600 family members, and 2,500 civilian personnel full-time. In addition, the MAGTFTC trains foreign military forces and up to 25% of the Fleet Marine Force (approximately 45,000 Marines) each year at the Combat Center, via service-level training in ground combat operations using live-fire, combined arms exercises. MAGTFTC also trains 5,000 Marines annually in the Marine Corps Communication and Electronics School.

NATURAL RESOURCES

The natural environment aboard the Combat Center is a desert mosaic of mountains separated by broad valleys, bajadas, ephemeral washes, dry lakes, dunes, and ancient lava fields. More than 320 vertebrate wildlife species, 1,500 invertebrates, and nearly 400 plant species are found aboard the Combat Center, including the federally-threatened Agassiz's desert tortoise (*Gopherus agassizii*) and at-risk species such as desert bighorn sheep (*Ovis canadensis nelsoni*), Mojave fringe-toed lizard (*Uma scoparia*), and crucifixion thorn (*Castela emoryi*). Management of this fragile ecosystem is guided by the installation’s Integrated Natural Resources Management Plan (INRMP), which outlines overarching goals, objectives,

and specific actions that sustain the mission and the quality of natural resources aboard the Combat Center.

INRMP

The Combat Center reviewed and significantly revised its INRMP during FY18 in consultation with the U.S. Fish and Wildlife Service and California Department of Fish and Wildlife, and in coordination with various stakeholder groups such as the Desert Tortoise Council. Signature on the revised INRMP is anticipated February 2019.



Left: A Red Spotted Toad blends into the surrounding rock.



Right: Mojave Fringe-toed Lizard basks in the sun. The fringes on its toes give it extra traction in sandy dunes.

The most notable changes to the INRMP were to extend INRMP coverage across the expanded installation (1,100 sqmi) and to identify the primary goal of the natural resources program as "Strengthen the Combat Center's Operational Capabilities." This goal explicitly aligns natural resources management aboard the Combat Center with execution of MAGTFTC's mission, driving staff to consider innovative approaches to conservation planning which include the needs and constraints of the military.

Adaptive management and ecological management principles are fundamental elements incorporated into the INRMP and

guide the Combat Center's stewardship of military lands. During the achievement period, Natural Resources section (2 government biologists and 1 contractor) worked to identify, plan, and assess the effectiveness of different aspects of resource management actions outlined in the INRMP.

PARTNERSHIPS

Ensuring the effectiveness of natural resources management is critical for the continued success of military training operations. Natural systems are not contained by political boundaries and coordination with neighboring land managers is frequently necessary to effectively address resource concerns. The Combat Center values and is continuing to develop partnerships with other governmental and private groups throughout the region for conservation initiatives.

LAND EXPANSION

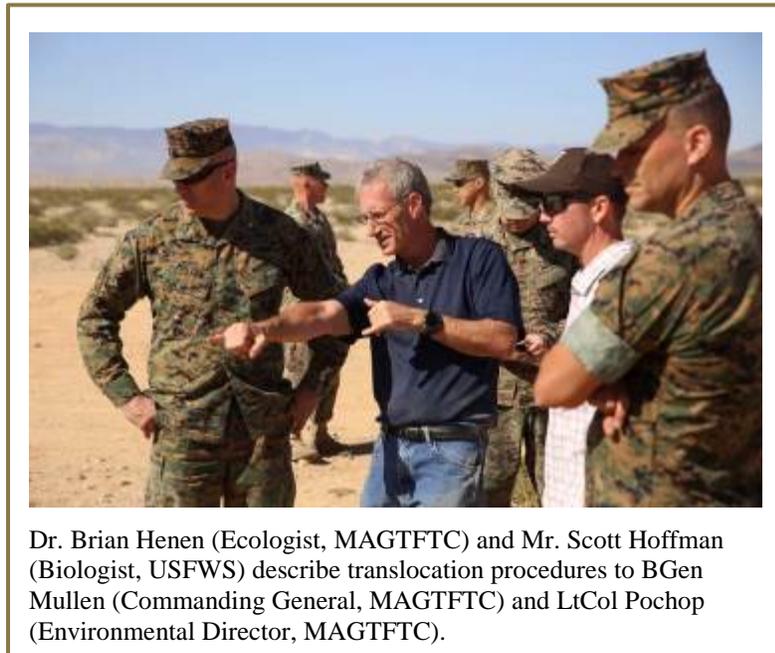
The value of the Combat Center's partnerships was apparent during the recent expansion of this installation. The National Defense Authorization Act of

Fiscal Year 2014 culminated several years of complex, large-scale environmental planning, authorizing expansion of the Combat Center to over 1,100 square miles, supporting sustained, combined-arms, live-fire and maneuver training for Marine Expeditionary Brigade-sized MAGTFs. This expansion also included an 88 square mile Shared-Use Area managed jointly by Bureau of Land Management (BLM) for public access and by the Combat Center for military training.

Implementation of the expansion and associated military training required translocation of unprecedented numbers of the federally-threatened desert tortoise. The

Combat Center worked closely with the Bureau of Land Management (cooperating agency) local and state offices, U.S. Fish and Wildlife Service (USFWS) local and regional offices, and headquarters elements of the U.S. Marine Corps and Department of Navy to complete, in mere months, a supplemental environmental impact statement analyzing impacts of this translocation. This team was successful despite significant time constraints, legal challenge, and a range-wide decline in the status of the species.

The Combat Center successfully translocated 1,232 desert tortoises from the expansion areas—the largest translocation in history by a significant margin. This allowed the large-scale exercise planned for summer 2017 to occur on schedule, opening 250 square miles of new Marine Corps lands to service-level combined-arms, live-fire, maneuver training.



Dr. Brian Henen (Ecologist, MAGTFCT) and Mr. Scott Hoffman (Biologist, USFWS) describe translocation procedures to BGen Mullen (Commanding General, MAGTFCT) and LtCol Pochop (Environmental Director, MAGTFCT).

Initial translocation results are very positive. The Combat Center has seen 9% annual mortality amongst translocated animals, and has not detected any significant difference between mortality in translocated, resident, and control populations. This compares

favorably to first-year results from other translocations, which saw mortality in the range of 25-50%. The efforts of this team were recently recognized with the 2018 SECNAV Environmental Award for Natural Resources Management—Team.

TORTOISE RESEARCH

The Combat Center continues to build research collaboration and translocation-related research opportunities.

Headstarting Desert Tortoises. The University of California, Los Angeles (UCLA) has collaborated on developing an innovative and successful desert tortoise headstart program at the Combat Center's Tortoise Research and Captive Rearing Site (TRACRS). In this program the Combat Center monitors and collects gravid female tortoises, holds them in natural pens until they

lay a clutch of eggs, and perform health assessments and rehydrate the female tortoises before release. Hatchlings are kept until they reach sufficient size and shell hardness to resist predation.

The headstart program has generated meaningful scientific study, including confirming polyandry in wild tortoise populations, confirming sperm storage by female tortoises (allowing for egg fertilization to be delayed until better resource availability), survivorship and growth rates (manuscript in preparation), and the first evidence of temperature-dependent sex determination of

offspring in natural conditions (Nagy et al 2016). The latter has implications for this species' climate resilience should temperature increases affect gender balance in tortoise populations.

The headstart program has demonstrated success, with significantly higher annual survivorship (96%) of hatchling and juvenile tortoises compared to survivorship in the wild (0-40%). Release to the wild of tortoises from the headstart facility continued through the award period with zero predation by ravens (a key program goal), demonstrating continued post-headstart survivorship benefits. These efforts support desert tortoise conservation objectives in the Combat Center's INRMP and the nationwide desert tortoise recovery plan. The Combat Center headstart program is informing similar efforts in the National Park Service, regional energy projects, and other military installations.



Dr. Ken Nagy of UCLA releases a juvenile tortoise that had been successfully headstarted in the Combat Center's TRACRS facility. This juvenile has grown large enough to resist predation by ravens.

Habitat Suitability and Climate Resilience.

The University of California, Riverside (UCR) and the Combat Center have cooperated on development of desert tortoise habitat modeling. This effort analyzes environmental variables associated with habitat suitability, degree of disturbance from natural and anthropogenic sources, and distribution and density of desert tortoise populations to identify current and predict future areas of habitat, under various climate

scenarios (Barrows et al 2016). This output informed recommendations in FY18 for where additional land expansion tortoises should be translocated as they are found or upon their attaining sufficient size to be safely released from temporary holding pens. The Combat Center is also considering climate resilience in its current INRMP management priorities, and in its Readiness and Environmental Protection Integration (REPI) planning refresh for future acquisition and conservation projects.

Desert Tortoise Genetics. The Combat Center has collaborated with several universities on studies of tortoise genetics. The University of Toronto (UT), Arizona State University (ASU), and University of Arizona (UofA) co-lead the first sequencing of the desert tortoise genome (Tollis et al. 2017), fundamentally supporting future genetic studies and providing a foundation for disease research (an area of particular concern for desert tortoise recovery). Researchers from UT, UofA, and U.S. Geological Survey partnered with the Combat Center in a landscape genomics study (Sanchez-Ramirez et al. 2018). This study built upon the genome sequencing to confirm that the Combat Center's land expansion translocation is within one population—suggesting little or

no concern about inbreeding depression or vigor associated with translocation and headstarting efforts.

Many researchers are using the genomic information to explore tortoise stress physiology, ecology, and evolution. For example, the Combat Center's cooperative agreement with UT and University of Florida will evaluate potential disease-related

manifestations as a foundation of future translocation success.

Post-Translocation Research. The Combat Center is leveraging its relationships with multiple universities to conduct translocation-related research under cooperative agreements. UCR is evaluating spatial assimilation of translocated tortoises within recipient sites, including analysis of habitat preferences. UCR is also evaluating whether current or historic grazing practices affect the distribution of resident and translocated tortoises—potential grazing effects on desert tortoises are a contentious issue in desert land management. UT and University of Florida (UF) are addressing genetic assimilation of the translocated tortoises (i.e., do translocated animals produce offspring with the resident population). UF and the San Diego Zoo are monitoring post-translocation disease prevalence.

This duo is also conducting post-translocation survivorship analysis.

DESERT BIGHORN SHEEP

As the only large mammal aboard the Combat Center, and with the federally-endangered Peninsular population less than 60 miles away, desert bighorn sheep (*Ovis canadensis nelsoni*) are of special management interest to the installation. At the Combat Center, partnerships are fundamental to bighorn sheep conservation. Since 1992 the Combat Center has joined with the California Department of Fish and Wildlife, Society for Conservation of Bighorn Sheep (SCBS), Wild Sheep Foundation (WSF), Desert Bighorn Council, and others to reintroduce permanent desert bighorn sheep populations into historic ranges, including aboard the installation. More recently, the Combat Center has

partnered with SCBS and WSF to install wildlife drinker systems (“guzzlers”) in its training areas to support these populations. Guzzlers capture and store natural rainfall, providing self-renewing, permanent water sources for bighorn sheep and other wildlife that extend permanent habitat and migratory corridors into and through the installation. Wildlife cameras placed at guzzler locations reveal consistent, year-round use by sheep.



A herd of desert bighorn sheep, including a dominant male, females, and young, hydrate at the Combat Center's Argos guzzler.

The Combat Center's non-profit partners have furnished guzzler systems worth a combined value of more than \$100,000 at no cost to the government, and provided more than 3,300 hours of volunteer labor surveying and siting appropriate guzzler locations, installing and upgrading systems, and providing maintenance and repair. In FYs17 and 18 the SCBS performed several reconnaissance missions, scouting and recommending specific locations for an additional four guzzler locations aboard the Combat Center. These would bring the total number to eleven systems, connect protected off-base habitat at opposite ends of the installation, and eliminate the Combat Center as a barrier to genetic flow between these populations.

California Department of Fish and Wildlife (CDFW) and the Combat Center have refreshed their 20-year old agreement in Oct 2017, with CDFW helicopter crews installing

Combat Center tracking collars on wild sheep. These collars reveal herd locations for easier population surveys, provide insight into movement patterns within regional habitat, and may document intermixing of herds when that occurs. This complements recent Combat Center management efforts, including habitat assessments, inventory and monitoring of surface water sources (all ephemeral), aerial herd surveys, genetic sampling, and use of game cameras to monitor specific resource use.



SCBS volunteers join together to install a donated guzzler system on the Combat Center.

Bighorn sheep management is integral to the Combat Center's on- and off-base conservation outreach efforts. The value of bighorn sheep conservation at the Combat Center has been recognized with several awards, including the prestigious Federal Statesman Award from the Wild Sheep Foundation in 2018 and the Plaque of Honor from the Desert Bighorn Council in 2017.

Bighorn sheep conservation aboard the installation continues to evolve. Conservation staff have begun exploring with the MAGTF Training Directorate opportunities for Marines to record sightings of bighorn sheep made on foot patrol, at observation posts, during routine aerial training maneuvers, and as targets for reconnaissance drone training. Bighorn sheep are naturally camouflaged,

wary of predators, and found in difficult terrain, often making them ideal dynamic training aids for these purposes.

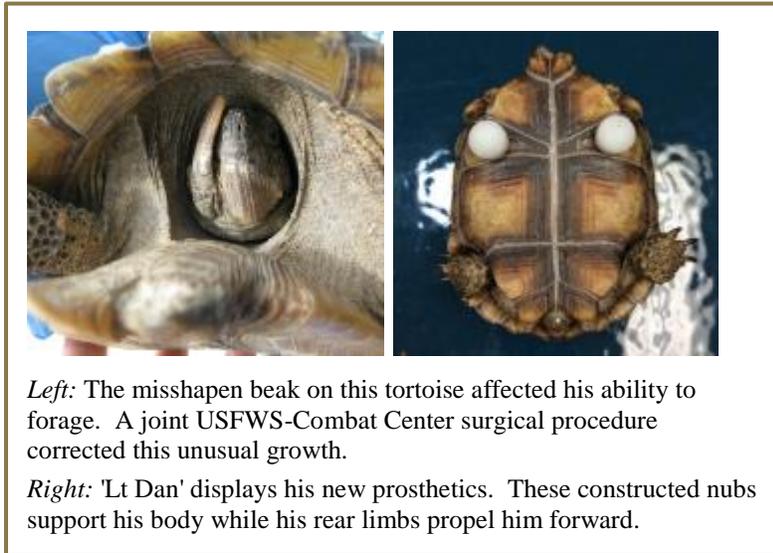
ANIMAL HUSBANDRY

The Combat Center has partnered with the resident U.S. Army veterinarian, off-base veterinarians, multiple chapters of the California Turtle and Tortoise Club (CTTC), and the USFWS for the care of injured wild tortoises and the disposition of domesticated tortoises. Recognizing the expertise residing in Combat Center staff, the USFWS requested assistance rehabilitating an emaciated desert tortoise ('Tank') found in a Ridgecrest mining site. Conservation staff used this as an opportunity to further cement the relationship with the on-base U.S. Army veterinarian, performing joint health assessments and exchanging information between the veterinarian and conservation staff regarding tortoise development and pathology. The Combat Center successfully rehabilitated this tortoise through the course of FY18, returning 'Tank' to the USFWS. On the back of this successful rehabilitation, USFWS and Combat Center staff worked jointly to repair a significantly misshapen beak on a Combat Center tortoise.

During translocation surveys biologists discovered two tortoises had sustained injuries from canid attack prior to translocation. The Combat Center worked with an outside veterinarian to cleanly amputate both forelimbs on 'Lt Dan' and one forelimb on 'Tripod' to reduce pain and likelihood of infection. This team then developed and produced via rapid accretive manufacturing prosthetics that restored some of the mobility lost through these injuries. The CTTC assisted the Combat Center in finding suitable homes for 'Lt Dan' and 'Tripod,' and for several domesticated tortoises found inappropriately released to the wild. Conservation staff provided seminars to

two chapters of the CTTC on desert tortoise biology and prosthesis development as part of the Combat Center's outreach activities.

actions, develop a consensus prioritization based on need, effectiveness, and cost, and present the prioritized projects to members to consider individually funding.



Left: The misshapen beak on this tortoise affected his ability to forage. A joint USFWS-Combat Center surgical procedure corrected this unusual growth.

Right: 'Lt Dan' displays his new prosthetics. These constructed nubs support his body while his rear limbs propel him forward.

Interagency Agreement with USFWS. In Aug 2018 the Combat Center entered into an Interagency Agreement with the U.S. Fish and Wildlife Service under authority of the Sikes Act. This agreement creates a framework wherein the Combat Center can request and reimburse the cost for services from USFWS for the execution of any projects identified in the INRMP concerning management of natural resources. This agreement allows for immediate funding of recovery monitoring in the

adjacent Ord-Rodman Critical Habitat Unit, documenting the local population status in the tortoise recovery unit in which the Combat Center resides.

In FY18 the Combat Center also entered into association with a local avian rehabilitator. This relationship helps ensure the rehabilitation facility can sustain operations, providing a local source for permitted rehabilitation services required by the Combat Center's Special Purpose permit under the Migratory Bird Treaty Act.

WAY FORWARD

The Combat Center is drawing together various research and planning actions completed over the last two years to develop an innovative method of strengthening its operational capabilities. The Combat Center has discussed with USFWS establishing a recovery crediting framework, allowing use of on- and off-base recovery actions to generate credits that could be used to relieve training restrictions. This effort would draw on the habitat and climate resilience modeling, genetic research, and proven headstarting methods described above to augment faltering desert tortoise populations with headstarted animals. USFWS has included the recovery crediting concept in the draft Species Action Plan being prepared to support the USFWS and DoD Recovery and Sustainment Partnership Initiative.

REGIONAL PLANNING

The Combat Center is an active participant in several regional desert committees and partnerships addressing shared land use and resource conservation issues.

Desert Tortoise Management Oversight Group (DT MOG). The Combat Center has long participated in the DT MOG. This group comprises Federal, State, and local governments, non-governmental organizations, and other stakeholders in desert tortoise recovery. The DT MOG advises the USFWS on desert tortoise recovery, disseminates scientific research and other information, and coordinates recovery actions between members. Region-specific teams review proposed desert tortoise recovery