

Defending the Steppingstones of Migration

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What comes to mind when you think of the Department of Defense and the environment?

The conservation of migratory birds and their habitats on military lands is probably *not* among your first thoughts.

The United States Department of Defense (DoD) manages approximately 25 million acres of land—much of it undeveloped, often for safety or for security buffers. Meanwhile, U.S. Army Corps of Engineers projects occupy an additional 12 million acres. Throughout the Americas, habitats that host high-priority and federally listed species are becoming increasingly threatened by development. Military installations often exist as oases of habitat in the midst of fragmented and developed landscapes. Although DoD-managed lands represent only about three percent of the total federal land inventory, the Military Services report that, as of 2000, their lands and waters were home to more than 300 federally threatened or endangered species. The lands under DoD management are among the most important of all federal land holdings (Keystone Center 1996).

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Military lands represent an incredible diversity of habitats—from mountain forests and meadows to coastal beaches and cliffs—and they harbor exceptional biological diversity, due to the wide range of training environments and strategic locations required to ensure the defense of the country. Realistic training of U.S. armed forces requires the use of air-to-ground ordnance, tracking vehicles, ship-to-shore ordnance, and amphibious assault maneuvers that can take a toll on the environment. However, as stated by former Air Force Chief of Staff General Thomas White: "The mission of DoD is more than aircraft, guns, and missiles. Part of the defense job is protecting the lands, waters, timber, and wildlife—the priceless natural resources that make this great nation of ours worth defending." According to Peter Boice, Conservation Team Leader for DoD: "DoD's natural resource management challenge is to guarantee continued access to our land, air, and water for realistic military training and testing, while ensuring that the resources entrusted to its care remain healthy and available for use by future generations." Included in the catalog of future generations are humans and nonhumans alike.

In 1991, DoD, through each of the military services, joined the Partners in Flight (PIF) initiative <<http://www.partnersinflight.org>>. Through its participation in this partnership, DoD actively pursues a sound conservation ethic in managing its public lands for the benefit of bird species throughout the Americas. Partners in Flight embraces the conservation of biological diversity by using birds as indicator species.

The DoD Partners in Flight (DoD-PIF) program <<http://www.dodpif.org>> offers a coordinated framework for incorporating the goals and objectives of the national PIF Bird Conservation Strategy, known as the *Flight Plan*, into installation integrated natural resources management plans.

The success of bird conservation and the DoD-PIF program on military lands, like the larger natural resources management framework, is due largely to two key factors: dedicated professionals and successful partnerships. DoD wildlife biologists and natural resources managers embody the thinking of Aldo Leopold (1949): "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." Balancing the needs of a military training mission with those of protecting biodiversity requires the institutional memory, expertise, and dedication exhibited by these civilian employees.

Endangered species management on military lands enjoys many success stories. Two issues of the *Endangered Species Bulletin* (Jan–Feb 1997 and Nov–Dec 2000) have had a DoD focus. However, these successes often come with a steep price tag. In fiscal year 2000, DoD spent over \$38 million managing endangered species, with bird species taking 62 percent (almost \$24 million). The Army alone spent \$17.4 million, almost half of the DoD total. Of that, \$11 million was spent on birds, and \$9.5 million was for just four species of birds: Red-cockaded Woodpecker, Black-capped Vireo, Golden-cheeked Warbler, and Palila¹ (*Loxioides bailleui*).

¹ In this article scientific names are provided for bird species that do not occur within the ABA area, as well as for ABA-area birds that are discussed at the subspecies level.

Video monitoring at Black-capped Vireo nest sites has proved to be a useful conservation tool at Fort Hood TX.

Saving the South

The Red-cockaded Woodpecker is well known to the birding community. More than 1100 active Red-cockaded Woodpecker clusters, between 25% and 33% of the entire population, exist on DoD-managed lands. Eglin Air Force Base in Florida, Fort Bragg in North Carolina, and Fort Stewart and Fort Benning in Georgia contribute about 1000 of these clusters.

Partnerships with The Nature Conservancy (TNC) contribute significantly to increasing Red-cockaded populations on each of these four installations. In fact, TNC now considers the southern longleaf pine ecoregion to have two distinct components: military and non-military.

The Longleaf Pine Restoration Project <<http://www.consci.org/eglin>> is a collaboration among Eglin Air Force Base, TNC, Tall Timbers Research Station, and the University of Florida to compare the effects of hardwood reduction techniques in fire-suppressed longleaf pine-dominated sandhills on Eglin Air Force Base. With less than 2% of the historical longleaf pine landscape remaining today, Eglin's 360,000 acres may be the largest remaining longleaf pine holding in public ownership. At least 1930 acres of this longleaf forest are old-growth (more than 150 years old). In addition to the largest number (301) of active Red-cockaded clusters on military lands, this project benefits the Northern Bobwhite, a species undergoing precipitous but indeterminate population declines, plus several species on the PIF Watch List: Southeastern American Kestrel (*Falco sparverius paulus*), Red-headed Woodpecker, Loggerhead Shrike, Brown-headed Nuthatch, and Bachman's Sparrow.

A partnership among Fort Bragg, the U.S. Army Environmental Center, TNC, the Sandhills Land Trust, and the U.S. Fish & Wildlife Service has taken a big step toward ensuring the future of one of the Army's premier installations and protecting longleaf pine ecosystems. The Conservation Center of the Sandhills is an effort to acquire and preserve private lands near



ALAN MURPHY

Noisy flocks of Brown-headed Nuthatches roam the longleaf pine forests of the southeastern United States. The species is a beneficiary of initiatives such as the Longleaf Pine Restoration Project, which is being carried out on Eglin Air Force Base in Florida.

Fort Bragg before they could be developed. For the Army, the goal of preserving the longleaf pine ecosystem supports the long-term sustainability of Fort Bragg training land. To date, about 3000 acres have been acquired. Through this innovative partnership, Fort Bragg's current Red-cockaded Woodpecker population of 280 clusters will undoubtedly benefit, and soldiers will continue to engage in realistic training missions.

The survival of the Black-capped Vireo and the Golden-cheeked Warbler was uncertain in the late 1980s due to the cumulative impacts of habitat loss, parasitism by Brown-headed Cowbirds, and predation by recently introduced fire ants. The breeding range of the Golden-cheeked Warbler is restricted to Texas, centered around the Edwards Plateau. The vireo breeds in Oklahoma, Texas, and northern Mexico. The birds nest exclusively in sparse oak-juniper woodlands, which occupy about a third of the 219,000 acres on Fort Hood TX. TNC began working with Fort Hood in 1992 and provides overall management for the warbler and vireo program. A successful cowbird trapping pro-

gram has reduced parasitism rates from over 90 percent to less than 10 percent and has increased nest success almost tenfold. Also included in the arsenal of high-tech tools is remote video nest monitoring, which has captured vireo nest-predators on film. Fort Hood now has the largest known breeding populations of both species under a single management authority, with at least 2000 Black-capped Vireos and 4000 Golden-cheeked Warblers.

California Squeeze

The human population of the southern California coastal region has grown more rapidly since World War II than has the human population of any other region of its size in the country. Marine Corps base Camp Pendleton occupies 123,000 acres of real estate that sit squarely in the middle of the burgeoning metroplexes of San Diego and Los Angeles. Since its purchase in 1942 for \$4,000,000, development has encroached upon its borders from both north and south, devouring wildlife habitat along with it. The endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) and up to 50% of the breeding population of the endangered Least Bell's Vireo (*Vireo bellii pusillus*) nest within its extensive riparian corridors, including along the Santa Margarita River, southern California's only free-flowing river. Coastal sage-scrub habitat on the base supports more than 600 pairs of the threatened California Gnatcatcher, as well as the Coastal Cactus Wren (*Campylorhynchus brunneicapillus couesi*) and Bell's Sage Sparrow (*Amphispiza belli belli*), both of which are California Bird Species of Special Concern.

The 920-acre Seal Beach National Wildlife Refuge lies within the borders of the 5,000-acre Seal Beach Naval Weapons Station, a few miles south of Long Beach along Anaheim Bay. Its saltwater estuary supports one of the three largest breeding populations of the endangered Light-footed Clapper Rail (*Rallus longirostris levipes*) and has been proposed as both a Western

Hemisphere Shorebird Reserve Network (WHSRN) site of regional significance and a Ramsar site. (Wetlands of international importance are named after Ramsar, a town in Iran where an international symposium on wetlands was held.) Adding in the 3,000 acres of open lands, the entire site attracts an incredible diversity of species, including wintering Mountain Plovers, Large-billed Savannah Sparrows (*Passerculus sandwichensis rostratus*), and Nelson's Sharp-tailed Sparrows, plus California Least Terns (*Sterna antillarum browni*) and Belding's Savannah Sparrows (*Passerculus sandwichensis beldingi*). Seal Beach is especially significant for wintering raptors. It is an important site for wintering juvenile Red-tailed Hawks, and it also hosts wintering Ferruginous Hawks and Peregrine and Prairie Falcons.

Beaches in the coastal crescent from San Diego north and west to Point Conception and Vandenberg Air Force Base are extremely popular—with birds and with humans. Most undeveloped beaches with suitable nesting habitat are found on military lands. Camp Pendleton has 17 miles of beach, a portion of which is shared as a state park. Twenty percent of the breeding population of the endangered California Least Tern nests here. Camp Pendleton and beaches in the San Diego area used for Navy SEAL training are responsible for up to 40 percent of the Least Tern fledglings in California. The 35 miles of undeveloped coastline on Vandenberg Air Force Base contain a mix of rocky cliffs and long sandy beaches, which host up to 250 breeding and nearly 500 wintering Western Snowy Plovers (*Charadrius alexandrinus nivosus*), a threatened taxon. In addition, Vandenberg's coastal sage-scrub habitat supports an impressive population of up to 325 pairs of resident Bell's Sage Sparrows.

Conserving Priority Habitats

In contrast to reactive endangered species management described above, the DoD Legacy Resource Management Program has administered about \$15 mil-

lion since 1991 for Partners in Flight projects on bird species that are *not* federally listed. Some of the focal habitat types covered under the proactive management of the Legacy Program are discussed below.

Grasslands

Native grasslands evolved as disturbance-dependent systems. Over 90% of their original range has been lost, making them one of the most endangered ecosystems in the country. Human-induced changes to the historic grassland landscape have included direct destruction of native grasslands and disruption or elimination of the natural disturbances that maintained their successional state. DoD lands possess some of the best remaining native grassland ecosystems in the United States. Military training may involve tank and artillery fire, laser firing (lasing), or prescribed burning that mimics the historic fire regime. Not surprisingly, some of the largest and most healthy populations of high-priority grassland bird species occur on these lands,

especially within the range of current or former prairie habitats. Grassland habitats are one of the highest conservation priorities for the DoD-PIF program (DoD-PIF 2002).

Fort Sill occupies more than 93,000 acres in the southwestern part of Oklahoma. Native mixed-grass and tall-grass prairie habitats interspersed with oak and mesquite savannas dominate the installation. Juxtaposed along the western end of Fort Sill's northern boundary is the 59,000-acre Wichita Mountains National Wildlife Refuge. Together, these two properties create a prairie ecosystem of more than 150,000 acres that supports Oklahoma's largest breeding population of Black-capped Vireos, in addition to numerous species that are characteristic of both eastern and western North America. Watch List species include Chuck-will's-widow and Western Painted Bunting (*Passerina ciris pallidior*).

The former Jefferson Proving Ground in Indiana supports one of the largest breeding populations of Henslow's Sparrow—



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This nearly pristine stretch of shoreline lies on Vandenberg Air Force Base, north of Los Angeles. It would surely have been developed long ago, were it not for the DoD presence here. This site provides critical habitat for breeding California Least Terns, as well as for breeding and wintering Western Snowy Plovers.

of the highest-priority grassland obligates on the Watch List. The U.S. Fish & Wildlife Service manages what is now the 50,000-acre Big Oaks National Wildlife Refuge. Prescribed burning has replaced the munitions and ordnance testing that maintained the 5,000-acre grassland used by this species. The refuge is a haven for other area-sensitive grassland and forest Watch List birds, including Red-headed Woodpeckers, Wood Thrushes, Prairie Warblers, Cerulean Warblers, Worm-eating Warblers, Kentucky Warblers, and Dickcissels.

In Kansas more than half of Fort Riley's 100,000 acres make up the largest remaining area of native tallgrass prairie in the world. Fort Riley contains the largest population of Henslow's Sparrows in the state, and perhaps throughout its range. Other breeding Watch List species include Greater Prairie-Chicken and Dickcissel.

Moving farther south, we come to Fort Campbell, a 105,000-acre Army base which straddles the Kentucky-Tennessee state line just east of Land Between the Lakes. Fort Campbell is a critical link in grassland bird conservation in the East. Its 40,000 acres of grassland and oak barrens lie at the southern edge of the former two-million-acre Kentucky Barrens. Initial surveys found at least 150 Henslow's Sparrow territories, probably a small fraction of the sparrow's numbers here. Significant numbers of Dickcissels and Grasshopper Sparrows, as well as some Bachman's Sparrows, also nest here. This area is being considered for Greater Prairie-Chicken reintroduction. A three-year study is underway here and at Fort McCoy WI to demonstrate that grasslands can support priority bird habitat while meeting military mission requirements.

In the Northeast, advancing succession on abandoned farmland is reducing available grassland and early successional habitat. Species such as Northern Harrier, Upland Sandpiper, Horned Lark, Vesper, Grasshopper, and Henslow's Sparrows, Dickcissel, Bobolink, and Eastern Meadowlark are increasingly finding refuge



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Henslow's Sparrows thrive at Fort Riley in Kansas, where prescribed burns and lasing help to create ideal habitat for a variety of grassland bird species.

on military installations such as Fort Drum NY, Westover Air Reserve Base MA, and the Naval Air Engineering Station in Lakehurst NJ. With the exception of the Upland Sandpiper, all of these species are declining throughout the northeast and mid-Atlantic regions. The loss of grassland habitat on private lands over the last 30 years has led to increases in early successional and grassland species on DoD lands in the mid-Atlantic region. Along with Bald Eagle nesting sites, grasslands are perhaps the most significant contribution to bird conservation by DoD lands in the mid-Atlantic region. In the Southeast, large Army bases like Fort Bragg often maintain sizable blocks of open habitat such as hay and fallow fields, drop zones (for human or cargo parachutes), or impact zones. Southeastern grassland and open-country species tend to occur here in larger numbers than in the surrounding landscape. In fact, the only stable breeding population of Lark Sparrows east of the Appalachians is at one of Fort Bragg's drop zones in Scotland County NC.

Arid and desert lands

The Western Burrowing Owl (*Athene cunicularia hypugaea*) is endangered in Canada, threatened in Mexico, and a species of special concern in many states in the U.S. It is showing widespread decline over most of its range. Although California and Texas appear to be the most important states for Burrowing Owls in winter, little is known about the species' migratory patterns. Naval Air Station (NAS) Lemoore has one of the largest year-round resident breeding owl populations in the San Joaquin Valley of California, and it hosts additional winter migrants. NAS Kingsville and the Naval Auxiliary Landing Field near Orange Grove are in areas of significant wintering habitat in south Texas. Lemoore (with Oregon State University and The Institute for Bird Populations) and the U.S. Navy in Texas (with Texas A&M University and the U.S. Geological Survey Biological Resources Division) are participating in studies to better understand how to identify and manage breeding and wintering

habitats for this species, including the use of artificial burrows away from roads to reduce mortality of wintering owls due to collisions with vehicles.

The more than three million acres of Nevada's Nellis Air Force Range conceal some notable mysteries, such as the fabled UFO labs at Area 51. It was recently discovered also to contain some ornithological surprises. The Great Basin Bird Observatory, with support from DoD-PIF and the Legacy program, partnered with the Air Force to conduct the first known avian surveys of the area as part of the Nevada Breeding Bird Atlas. A small outpost of Mojave Desert vegetation, including Joshua trees and other warm-desert plants, was found on the northern portion of Nellis. Several resident desert species, notably Ladder-backed Woodpecker and Cactus Wren, were observed here, some 100 miles north of the previously known limit of their range.

Tropical habitats

Habitat destruction and disturbance are the primary threats to West Indian birds. The quality of overwintering habitat can inhibit the productivity of neotropical migrants on their temperate breeding grounds, as well as the survivorship of endemic island species. Studies on Navy installations in Puerto Rico and Cuba are examining factors affecting productivity and survivorship of bird species in tropical arid-scrub, mudflat, mangrove, and dry-forest habitats. In addition to numerous migrant warblers and shorebirds on both islands, endemic species such as Cuban Pygmy-Owl (*Glaucidium siju*), Cuban Tody (*Todus multicolor*), Cuban Green Woodpecker (*Xiphidiopicus percussus*), Cuban Vireo (*Vireo gundlachi*), Cuban Gnatcatcher (*Poliophtila lembeyi*), Oriente Warbler (*Teretistris fornsi*), Cuban Blackbird (*Dives atroviolacea*), and Cuban Grassquit (*Tiaris canora*) are found on Naval Station Guantanamo Bay. In Puerto Rico, the endangered endemic Yellow-shouldered Blackbird (*Agelaius xanthomus*) has been

observed on Naval Station Roosevelt Roads in a most unexpected and previously unknown habitat for this rare species: residential areas. At least eleven high-priority PIF Watch List species winter on Navy lands in the West Indies. DoD's greatest conservation opportunity is to preserve and restore the mangrove forests on Puerto Rico and Cuba.

For most of the twentieth century, DoD was an influential presence in the Republic of Panama. All DoD-controlled lands around the Panama Canal were transferred to Panama by the end of 1999 under the mandates of the Panama Canal Treaties.

Only a small percentage of the 80,000 acres of land that was under DoD care is developed, and 63,000 acres are tropical forests. These forests include some of the best examples of semi-deciduous forested habitat remaining along the Pacific coast of Central America. This region acts as a funnel for millions of neotropical migratory birds during their biannual migrations and is crucial to the overwinter survival for migrants such as Acadian Flycatcher and Bay-breasted and Prothonotary Warblers. Through the efforts of DoD-PIF, working with myriad conservation groups and with the Panamanian government, the most crit-



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Western Burrowing Owl is a listed taxon in Canada, Mexico, and the United States. Researchers at DoD installations in California and Texas are conducting studies to improve our understanding of habitat management for the species.



This map shows the locations of DoD installations that are referred to in the accompanying article.

ical habitats either have been set aside as protected areas or incorporated into the existing Parque Nacional Soberanía. The upper Panama Bay remains one of the most significant shorebird stopover and wintering sites in the Western Hemisphere. A study by the Center for Conservation Biology (Watts and Bradshaw 1998) showed the significance of mangroves as the basis for the intertidal zone food chain, which supports up to two million shorebirds each fall. The site qualifies both as a Ramsar site (wetlands of international significance) and as a WHSRN site (shorebird staging grounds of hemispheric significance). Formalizing these designations would help hold off the intense development pressure being experienced along these shores.

Conservation Through Technology

DoD has sponsored research to develop and test technologies that help to unravel some of the mysteries of bird migration. Peregrine Falcon migration and wintering data, a conundrum even after more than 25 years of leg-band returns, are now well known from satellite telemetry. Satellite tracking also helped to uncover the inadvertent poisoning of Swainson's Hawks on their wintering grounds in the pampas region of Argentina. Also, it is hoped that satellite tracking will lead researchers to the source of contaminants in White-faced Ibis populations breeding in western Nevada, including NAS Fallon. A decade of research has determined that high levels of DDE, the

principal metabolite of DDT, are not being acquired on the Nevada breeding grounds.

The use of radar ornithology as a conservation tool was pioneered by Prof. Sidney Gauthreaux of Clemson University. Maps of migration stopover "hot spots" and a national migration map have now been created, through the extensive analysis of weather surveillance radar (WSR) data. Prof. Gauthreaux has worked with DoD to extend the use of this technology to flight safety, using both WSR and modified marine radar. The Air Force and Navy BASH (Bird Aircraft Strike Hazard) programs now use a combination of historical data (like Christmas Bird Count data for wintering vultures) and real-time radar data to reduce the BASH risk to military pilots.

Noise from military training activities is another potential impact on birds. Military Operations Areas (MOAs) are designated three-dimensional air space in which military aircraft can conduct training flights. Alaska MOAs get extensive training use by U.S. and allied pilots. Large MOAs traverse both the Yukon and Tanana River valleys, which also support nesting Peregrine Falcons. An innovative study used a remote, solar-powered audio/video capture system created by a U.S. Fish & Wildlife Service biologist to record overflight intensity (in decibels) and any reaction by the falcons. Falcons were shown to habituate readily to noise. The only negative reaction appears to be a bird's inability to see a plane approaching. If the falcon is able to see the aircraft, it is apparently not perceived as a threat, no matter how loud. The Alaska Bird Observatory just completed a three-year study to determine whether intense jet noise at Eielson Air Force Base near Fairbanks is adversely affecting nesting passerines. Initial results that indicate that there is no difference in either nesting success or stress between the study site at Eielson Air Force Base and a "quiet" control site. Blood samples measured the concentrations of corticosterone, a hormone triggered in response to stress. Curiously, Yellow-rumped "Myrtle" Warblers (*Dendroica coronata hooveri*, of the *coronata*

group) showed higher baseline corticosterone levels at the control site. The lead investigator noted the following: "The birds I watched at Eielson seem unfazed when an F-16 screams overhead, whereas their duties are usually hampered by the presence of their goshawk neighbor." Observations before and after rocket launches at Vandenberg Air Force Base also seem to show that some marine mammals, seabirds, and colonial waterbirds are not significantly impacted by the incredible noise levels. Nest success of Brandt's Cormorant shows no significant impact due to launches.

Successful Partnering

Using the Partners in Flight model has garnered numerous successes for DoD. The DoD-PIF program is cited as a model partnership program by Leslie *et al.* (1996). DoD-PIF has twice received the Certificate of Environmental Achievement as an outstanding program in the Renew America Environmental Success Index, given by the National Awards Council for Environmental Sustainability. The annual PIF awards highlight outstanding contributions to bird conservation throughout the Americas. In the past two years, five awards have gone to DoD installations or individuals in three different categories: Stewardship (Holloman Air Force Base in New Mexico, plus Fort Riley), Investigations (Fort Hood, plus Dr. Richard Fischer of the U.S. Army Corps of Engineers Research and Development Center), and Leadership (Chris Eberly of DoD-PIF). At least 25 DoD sites and Army Corps projects are identified as Globally Important Bird Areas (IBAs) on the recently published map by the American Bird Conservancy (ABC) in partnership with the National Geographic Society (available from ABA Sales), and in ABC's forthcoming IBA book. Many additional installations are identified as state and national IBAs.

Partnerships, as highlighted throughout this article, play a major role in DoD's bird conservation efforts. In addition to the

already-mentioned partnerships with TNC, no fewer than a dozen other installations have created similar agreements. A number of installations share jurisdiction or management with the U.S. Fish & Wildlife Service. Some of these are former DoD sites that are now managed as National Wildlife Refuges, some are "overlay" refuges contained within the borders of an active installation, and some installations work cooperatively with refuges that share a common boundary. The Orchard Training Area in southwest Idaho is contained within lands administered by the U.S. Bureau of Land Management as the Snake River Birds of Prey National Conservation Area. Several National Guard units train on lands in the National Forest system.

Public Birding Opportunities

Are there opportunities for the public to view birds on military lands? Yes! DoD

participates in the Watchable Wildlife program, and many installations allow access to great birding locations. Although access restrictions have changed in the last year, most installations remain open. You must show proof of vehicle insurance, registration, and a valid driver's license to obtain a vehicle registration pass. Due to the nature of their military mission, however, some installations do not allow access, and others restrict access to certain areas or times. Visit the DoD-PIF web site <<http://www.dodpif.org>> or contact an installation's natural resources manager, for information regarding access and the availability of bird checklists for specific sites. Also, future issues of *Winging It* will feature an occasional series of birdfinding guides to military lands.

Innovative partnerships and solutions shape the success of DoD-PIF projects and programs. As the competition for training space increases and weapon systems



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DoD researchers hope that their satellite tracking program will enable them to determine the source of contaminants in White-faced Ibis populations that breed at the Fallon Naval Air Station in western Nevada.

become more sophisticated, demands on and conflicts with DoD's biologically diverse training lands increase. DoD biologists and natural resources managers show incredible resourcefulness in resolving difficult management problems, often involving federally listed or Watch List species. Implementing a biogeographical approach to land management and bird conservation helps DoD to better assess mission impacts and improves long-term planning. It also enhances opportunities for exemplary conservation partnerships, promotes better integration of mission and resource requirements, and provides some unique opportunities for the birding public. We invite you to see for yourself how DoD-PIF is "defending the steppingstones of migration".

Acknowledgments

I thank Peter Boice, Alison Dalsimer, and Joe Hautzenroder for data, as well as for review comments. Kristen Bartecchi, John Bradley, Slader Buck, Robert Chipley, John Cornelius, Jim Corven, Rich Fischer, Ted Floyd, Nancy Read Francine, Walker Golder, Jim Hessil, Jeff Keating, John Lovio, and Bryan Watts helped me to get the facts straight.

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