

Species at Risk on Department of Defense Lands:

2014 Updated Analysis, Report, and Maps

Report and Documentation

Prepared for:

Department of Defense

Legacy Program

Project 14-772



Submitted by:



February 2015

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1.0 Executive Summary

Department of Defense (DoD) lands play an essential role in maintaining homeland security, and are also important for safeguarding the nation's natural heritage. Managing DoD lands in a way that both supports military readiness and sustains ecological integrity requires an understanding of the species and ecosystems that are found on and around these bases.

In order for DoD to effectively protect, manage, and monitor at-risk species on its lands, DoD must have up-to-date information on where these species occur on their lands nationwide. Utilizing the most current species location data in NatureServe's databases, NatureServe conducted an analysis of species at risk on DoD lands, providing lists of species by installation, and revised maps and figures.

This 2014 analysis represents an update of a previous analysis by NatureServe, also funded by the Department of Defense Legacy Program that was based on 2011 species location data. Prior to the 2011 update, this same analysis had last been completed based on 2002 species location data. It is critical to make use of the most current and accurate species status and location data, since this information is continually changing and being updated and refined, and numerous new species occurrences are added to the database each year.

In this updated analysis, we define ***species at risk*** as plant and animal species that are not yet federally listed as threatened or endangered under the Endangered Species Act, but that are federally designated as proposed or candidates for listing, are regarded by NatureServe as critically imperiled or imperiled (G1 or G2) throughout their range, or are birds that are regarded by NatureServe as vulnerable (G3) throughout their range or have an IUCN status of CR, EN, VU, or NT. NatureServe provides two major types of analyses in this report: (1) analyses of species at risk that are highly dependent on DoD lands and management for their survival, and (2) analyses of installations with high numbers or densities of species at risk. These analyses aim to help DoD to direct resources towards both high priority species and high priority installations.

A key finding of our updated 2014 assessment is that the total number of species at risk on DoD lands remained similar to the numbers based on the 2011 and 2002 data. In 2014, we found 555 total species, which included the addition of birds with IUCN status that had not previously been included in the past analyses. The addition of these birds was requested by the Department of Defense since many sensitive and declining bird species are high priorities for DoD, but do not otherwise meet the project criteria. Without including the IUCN status birds in the total count, the total is 531 species, which is only slightly higher than the totals from 2011 and 2002.

Species at Risk on DoD Installations

A total of 555 species at risk are now reported in 2014, compared to 519 species in 2011, and 523 species reported in the 2004 report (which was based on the 2002 data). These total numbers have changed very little despite an increase of over 17,800 new species at risk population occurrences in NatureServe's databases since 2011. On closer inspection, although the total numbers have changed little over the past decade, the actual species on the lists have changed fairly significantly. The reasons for these changes in species lists are due to several factors, including new population occurrences added to the NatureServe databases, more precise species location information, changes in federal status, changes in taxonomy, and changes in species conservation status assessment ranks.

2014 Numbers of Species at Risk on DoD Installations:

SAR Category	Number of species based on 2014 data
Candidate or Proposed under the U.S. ESA	38
Rank G1 / T1	147
Rank G2 / T2	346
Bird: G3 and/or IUCN status	24
TOTAL in 2014	555
<i>Total without birds</i>	531

2.0 Introduction – Project Description

Department of Defense (DoD) lands play an essential role in maintaining homeland security, and are also important for safeguarding the nation's natural heritage. Managing DoD lands in a way that both supports military readiness and sustains ecological integrity requires an understanding of the species and ecosystems that are found on and around these bases. What species at risk are found on these military lands? On which installations are they most abundant? How can management of habitat on military lands help maintain these species and avoid the need for their listing under the Endangered Species Act? This report helps DoD to answer these important questions.

Department of Defense lands are thought to support more federally listed species than any other major federal agency, and to harbor more imperiled species than lands managed by either the National Park Service or U.S. Fish and Wildlife Service (Groves et al. 2000a). Many military bases are located in biologically rich areas of the United States, including coastal areas where human development is a major threat to biodiversity. Some of these bases have become the last refuges of imperiled species habitat in rapidly urbanizing landscapes. Proactive conservation of imperiled species and their habitats on and around DoD installations can help preclude the need for federal listing, reduce recovery costs, and protect significant biological diversity, while enabling the services to continue providing high quality military training. NatureServe's work under this project is intended to assist the military in focusing conservation efforts towards species that may warrant federal listing if population declines occur or continue.

NatureServe is the leading source of the "best available" information on the status and locations of rare and imperiled species and ecosystems in the United States. Many organizations and federal agencies, including the U.S. Fish and Wildlife Service (USFWS), use NatureServe's conservation status ranks to guide their conservation priorities. This information is developed centrally by NatureServe scientists and by each member natural heritage program using a standardized methodology. This methodology has been in use across the NatureServe network for several decades, and allows NatureServe data managers to analyze changes in the dataset over time.

In 2011 and 2004, NatureServe provided the USFWS and DoD with a report, analyses, and maps identifying Species at Risk (SAR) on DoD lands. This analysis and the resulting products – including lists of SAR by installation, numbers of SAR on each installation, and maps depicting numbers and density of SAR on installations nationwide -- were based on the current species locational data in NatureServe's databases at the time.

For the original analysis, which utilized species locational data from 2002 (as reported in the final, updated report for DoD dated January 2004), there were 44,317

total element occurrences (for the definition of “element occurrence”, see section 3.1.2) across the U.S. that met the criteria of the project: i.e., ‘Species at Risk’ are defined as native, regularly occurring species in the U.S. that are not federally listed under the U.S. Endangered Species Act, but that are either candidates for listing or are ranked by NatureServe as critically imperiled (G1 or T1) or imperiled (G2 or T2) throughout their range.

NatureServe and its member natural heritage programs are continually updating species occurrence information in our databases, and currently, as of December 2014, there are about 87,700 total element occurrences across the U.S. that meet the criteria of the project. This represents more than 17,800 new element occurrences in our databases for Species at Risk. In addition to these new and updated element occurrences, species conservation status ranks and supporting information are reviewed and updated on a regular basis.

In order for DoD to effectively protect, manage, and monitor at-risk species on its lands, DoD must have up-to-date information on where these species occur on their lands nationwide. With the most current species location data in NatureServe's databases, NatureServe in this report provides updated lists of Species at Risk by installation and revised maps and figures.

For the purposes of this project, we define **species at risk** (also referred to as *at-risk species*) as plant and animal species that are not federally listed as threatened or endangered under the U.S. Endangered Species Act, but that are federally designated as proposed or candidates for listing, are regarded by NatureServe as critically imperiled or imperiled (G1 or G2) throughout their range, or are birds that are regarded by NatureServe as vulnerable (G3) throughout their range or have an IUCN status of CR, EN, VU, or NT. Species at risk included in this report must also have at least one population that occurs on or near (within a 2-kilometer/1.24-mile buffer) a DoD installation. The federal designations (proposed, candidate) for species in this analysis are current as of the date the data was exported: December 8, 2014.

In this report, NatureServe provides two major types of analyses which are detailed in the results section: (1) analyses of species at risk that occur only or mostly on DoD lands or that are otherwise highly dependent on DoD management for their survival, and (2) overall summary analyses of installations with high numbers or densities of species at risk. These analyses aim to help DoD to direct resources towards both high priority species at risk and high priority installations.

3.0 Methods

NatureServe is the leading source of the “best available” information on the status of rare and imperiled species and ecosystems in the United States. Many organizations and federal agencies, including the U.S. Fish and Wildlife Service, use NatureServe’s conservation status ranks to guide their conservation priorities. This information is developed centrally by NatureServe and by each member natural heritage program using a standardized methodology. In this section, we define the methodology and analyses used in this report.

In order to help DoD focus conservation efforts on rare and imperiled species on DoD installations, NatureServe conducted an analysis based on the actual locations of species, specifically *species at risk* (defined in Section 3.3 below), occurring on or near DoD installations. The fundamental units of this analysis, which we define below, are the **element**, representing a full or infraspecies taxa, and the **element occurrence**, representing an observed location of an element. The analysis also utilized the NatureServe **conservation status ranks** (defined in Section 3.1.3 below).

3.1 NatureServe Data

3.1.1 Element

An **Element** is defined as a unit of natural biological diversity, representing species (or infraspecies taxa), ecological communities, or other non-taxonomic biological entities, such as migratory species aggregation areas. For the purposes of the analysis of species at risk on DoD installations, these elements of diversity refer to the locations of **species** and **infraspecies taxa** (e.g. varieties, subspecies, populations) only. No ecological communities or other element units such as migratory stopover locations are included in the datasets or analyses provided.

3.1.2 Element Occurrence

The **Element Occurrence** is the mapping unit developed by natural heritage programs for documenting the distribution of species populations. Formally defined as “an area of land and/or water in which a species or natural community is, or was, present,” an element occurrence ideally reflects species population units: either a distinct population, part of a population (subpopulation), or a group of populations (metapopulation). For the purposes of this report, the element occurrence is the basic unit used to determine whether a species at risk occurs on a DoD installation, as described in Section 3.3.2. Element occurrence records that are unmappable, known to be misidentified, or have been determined by NatureServe to be historical or extirpated are excluded from the analysis.

3.1.3 NatureServe Conservation Status Ranks

3.1.3.1 Description of NatureServe Conservation Status Rank Criteria

Determining which species and ecosystems are thriving and which are rare or declining is crucial for targeting conservation towards elements of biodiversity in greatest need. NatureServe and its member programs and collaborators use a suite of factors to assess the conservation status of plant, animal, and fungal species, as well as ecological communities and systems. These assessments lead to the designation of a conservation status rank. For species, these ranks provide an estimate of extinction risk, while for ecological communities and systems they provide an estimate of the risk of elimination. Conservation status ranks for ecological systems in North America are currently under development

Conservation status ranks are based on a one to five scale, ranging from critically imperiled (G1) to demonstrably secure (G5). Status is assessed and documented at three distinct geographic scales-global (G), national (N), and state/province (S).

Interpreting NatureServe Conservation Status Ranks

The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global), N = National, and S = Subnational). The numbers have the following meaning:

- 1 = critically imperiled
- 2 = imperiled
- 3 = vulnerable
- 4 = apparently secure
- 5 = secure.

For example, G1 would indicate that a species is critically imperiled across its entire range (i.e., globally). In this sense the species as a whole is regarded as being at very high risk of extinction. A rank of S3 would indicate the species is vulnerable and at moderate risk within a particular state or province, even though it may be more secure elsewhere.

Species and ecosystems are designated with either an "X" (presumed extinct or extirpated) if there is no expectation that they still survive, or an "H" (possibly extinct or extirpated) if they are known only from historical records but there is a chance they may still exist. Other variants and qualifiers are used to add information or indicate any range of uncertainty. For complete descriptions of ranks and qualifiers, see Appendix 5.1 or <http://www.natureserve.org/conservation-tools/conservation-status-assessment>

Global, National, and Subnational Assessments

The overall status of a species or ecosystem is regarded as its "global" status; this range-wide assessment of condition is referred to as its global conservation status rank (G-rank). Because the G-rank refers to the species or ecosystem as a whole, each species or ecosystem can have just a single global conservation status rank. The condition of a species or ecosystem can vary from one country to another, and national conservation status ranks (N-rank) document its condition in a particular country. A species or ecosystem can have as many N-ranks as countries in which it occurs. Similarly, status can vary by state or province, and thus subnational conservation status ranks (S-rank) document the condition of the species or ecosystem within a particular state or province. Again, there may be as many subnational conservation status ranks as the number of states or provinces in which the species or ecosystem occurs.

National and subnational status ranks must always be equal to or lower than the global rank for a particular species or ecosystem (in this sense a "lower" number indicates greater risk). On the other hand, it is possible for a species or ecosystem to be more imperiled in a given nation or state/province than it is range-wide. As an example, a species may be common and secure globally (G5), vulnerable in the United States as a whole (N3), yet critically imperiled in Florida (S1). In the United States and Canada, the combination of global and subnational ranks (e.g., G3S1) are widely used to place local priorities within a broader conservation context.

Global conservation status assessments generally are carried out by NatureServe scientists with input from relevant member programs and experts on particular taxonomic groups. NatureServe scientists similarly take the lead on national-level status assessments in the United States and Canada, while state and provincial member programs assess the subnational conservation status for species found in their respective jurisdictions.

Status assessments ideally should reflect current conditions and understanding, and NatureServe and its member programs strive to update these assessments with new information from field surveys, monitoring activities, consultation, and scientific publications. NatureServe partners with significant new or additional information are encouraged to contact NatureServe or the relevant natural heritage program or conservation data center.

To ensure that NatureServe's central databases represent the most current knowledge from across our network of member programs, data exchanges are carried out with each natural heritage program and conservation data center approximately once a year. The subnational conservation status ranks (S-ranks) presented in NatureServe analyses are therefore only as current as the last data exchange with each member program. Although most subnational conservation status ranks do not change frequently, the most current S-ranks can be obtained directly from the relevant local

heritage program or conservation data center (contact information available at <http://www.natureserve.org/natureserve-network>).

Status Assessment Criteria

Use of standard criteria and rank definitions makes NatureServe conservation status ranks comparable across organism types and political boundaries. Thus, G1 has the same basic meaning whether applied to a salamander, a moss species, or a forest community. Similarly, an S1 has the same meaning whether applied to a species or ecosystem in Manitoba, Minnesota, or Mississippi. This standardization in turn allows NatureServe scientists to use the subnational ranks assigned by heritage programs and conservation data centers to help determine and refine global conservation status ranks.

Ten factors are used to assess conservation status, grouped into three categories – **rarity**, **trends**, and **threats**.

- The **rarity** category factors are Population Size (for species), Range Extent, Area of Occupancy, Number of Occurrences (i.e., distinct populations), Number of Occurrences or Percent Area with Good Viability/Ecological Integrity, and Environmental Specificity.
- The **trends** factors are Long- and Short-term Trend in population size or area.
- The **threats** factors are overall Threat Impact, which is determined by considering the scope and severity (i.e., magnitude or impact) of major threats, and Intrinsic Vulnerability. NatureServe has developed a “rank calculator” to increase the repeatability and transparency of its ranking process. The “rank calculator” assigns a conservation status rank, based on weightings assigned to each factor and some conditional rules.

Relationship to Other Status Designations

NatureServe conservation status ranks are a valuable complement to legal status designations assigned by government agencies such as the U.S. Fish and Wildlife Service and the National Marine Fisheries Service in administering the U.S. Endangered Species Act (ESA), and the Canadian Wildlife Service in administering the Species at Risk Act (SARA). NatureServe status ranks, and the documentation that support them, are often used by such agencies in making official determinations, particularly in the identification of candidates for legal protection. Because NatureServe assessment procedures-and subsequent lists of imperiled and vulnerable species-have different criteria, evidence requirements, purposes, and taxonomic coverage than official lists of endangered and threatened species, they do not necessarily coincide. For more information see “Appropriate Use of NatureServe Conservation Status Assessments in Species Listing Processes”

(<http://www.natureserve.org/prodServices/pdf/NatureServeStatusAssessmentsListing-Dec%202008.pdf>).

The International Union for Conservation of Nature (IUCN) Red List of threatened species is similar in concept to NatureServe's global conservation status assessments. Due to the independent development of these two systems, however, minor differences exist in their respective criteria and implementation. Recent studies indicate that when applied by experienced assessors using comparable information, the outputs from the two systems are generally concordant. NatureServe is an active participant in the IUCN Red List Programme, and in the region covered by NatureServe, NatureServe status ranks and their underlying documentation often form a basis for Red List threat assessments. In recent years, NatureServe has worked with IUCN to standardize the ratings for shared information fields, such as Range Extent, Area of Occupancy, Population Size, and Threats. This standardization permits the sharing of information between organizations and countries, and allows the information to be used in both IUCN as well as NatureServe assessments.

3.2 DoD Installations

3.2.1 Installation Boundaries

For the purposes of this report, military installation boundaries are determined based on military installations identified in the dataset “Military Installations, Ranges, and Training Areas” (11/21/2014) that is publically available from: <http://explore.data.gov/National-Security-and-Veterans-Affairs/Military-Installations-Ranges-and-Training-Areas/wcc7-57p3>

In coordination with DoD, we determined that this layer best represents the location and boundaries of military installations across the country. Some installations are represented only as points and do not have polygon representations; DoD confirmed that these could be excluded from the analysis. The analysis is for the 50 U.S. states; DoD installations in Guam or Puerto Rico are not included. Using ArcMap, the remaining DoD installations represented in the polygon layer were buffered by 2 kilometers. The resulting buffered areas were used to conduct the analyses.

3.2.2 Fort Bliss Military Reservation and White Sands Missile Range

Element occurrence data are not currently available for species on Fort Bliss Military Reservation (FBMR) or White Sands Missile Range (WSMR) in New Mexico and Texas. These installations were excluded from all analyses and results in this report. For more information about Species at Risk for White Sands Missile Range, or the New Mexico portion of Fort Bliss/McGregor Range, please contact the Natural Heritage New Mexico program (<http://nhnm.unm.edu/>; 505-277-3822), or contact the installations directly. For more information about the Texas portion of Fort Bliss, please contact the Texas Parks and Wildlife Department (<http://www.tpwd.state.tx.us/>; 512-389-8111) and

the Texas Natural History Survey

(<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/texas/index.htm>; 210-224-8774), or contact the installation directly.

3.3 Species at Risk

3.3.1 Species at Risk Conservation Status Criteria

For the purpose of this report, *species at risk* are defined as native, regularly occurring species in the United States that are not federally listed under the U.S. Endangered Species Act, but are either:

- *Candidates* for listing under the U.S. Endangered Species Act, or
- *Proposed* for listing under the U.S. Endangered Species Act, or
- *Critically imperiled* (rounded global rank of G1 or T1) or *Imperiled* (rounded global rank of G2 or T2) plants and animals, according to the NatureServe conservation status rank criteria, or
- *Vulnerable birds* with a rounded global rank of G3 according to the NatureServe conservation status rank criteria or an IUCN status of CR, EN, VU, or NT.

Accordingly, four categories of species are used for most analyses in this report:

- Category 1: Federal Proposed or Candidate
- Category 2: Critically Imperiled (rounded global rank = G1/T1)
- Category 3: Imperiled (rounded global rank = G2/T2)
- Category 4: Vulnerable Birds (rounded global rank = G3/T3 or IUCN status = CR, EN, VU, or NT)

Note that categories 2, 3, and 4 are mutually exclusive (e.g. a species can only have a rank of G1/T1 or G2/T2 or G3/T3), while species in category 1 may also have rounded global ranks of G1/T1, G2/T2, G3/T3, or other global ranks. Federal status designations (according to the U.S. Fish and Wildlife Service listing process under the Endangered Species Act) and NatureServe conservation status ranks are not always consistent as they use different systems and criteria to designate rare species.

3.3.2 Species at Risk Location Criteria

Species at risk are considered to be located on a DoD installation(s) if one or more element occurrence(s) of that species resides within a 2 km (1.24 mi) distance of a DoD installation according to the USGS coverage described previously.

Given these location criteria, it is important to note that results indicating species presence on any particular installation may include species occurrences that reside in

the 2 km buffer zone. This buffer zone (also referred to in the report as “closely adjoining lands”) has been included for several reasons:

- the location of a species at risk occurrence near an installation may indicate that the occurrence is actually found on both sides of the fence;
- there may be data gaps on installations due to a lack of inventory and/or data sharing with NatureServe’s member state natural heritage programs.

3.3.3 Species at Risk Metrics

Two metrics of at-risk species are assessed in this report: (1) *number* of species at risk on DoD installations and (2) *density* of species at risk density on DoD installations. The latter metric, calculated as number of species per 100 square miles, is needed to compare species presence on DoD installations of varying sizes.

4.0 Results

4.1 Nationwide Assessment of Species at Risk on DoD Installations

4.1.1 Species at Risk

Figure 1. Percentage of Species at Risk by Status on DoD Lands

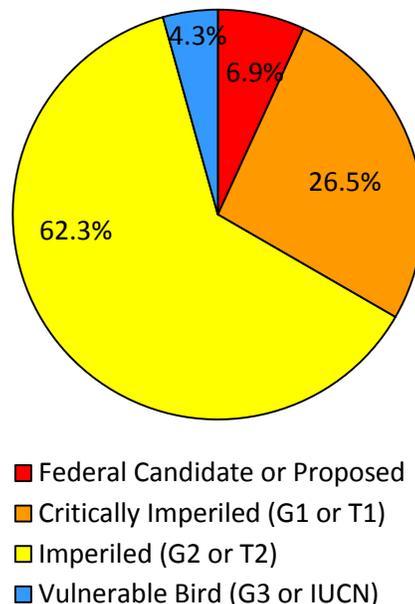


Figure 1 shows the imperiled (G2 or T2) make up over half of the SAR on DoD lands, while about seven percent are Federal candidate or proposed species.

Figure 2. Percentage of Species at Risk by Species Group on DoD Lands

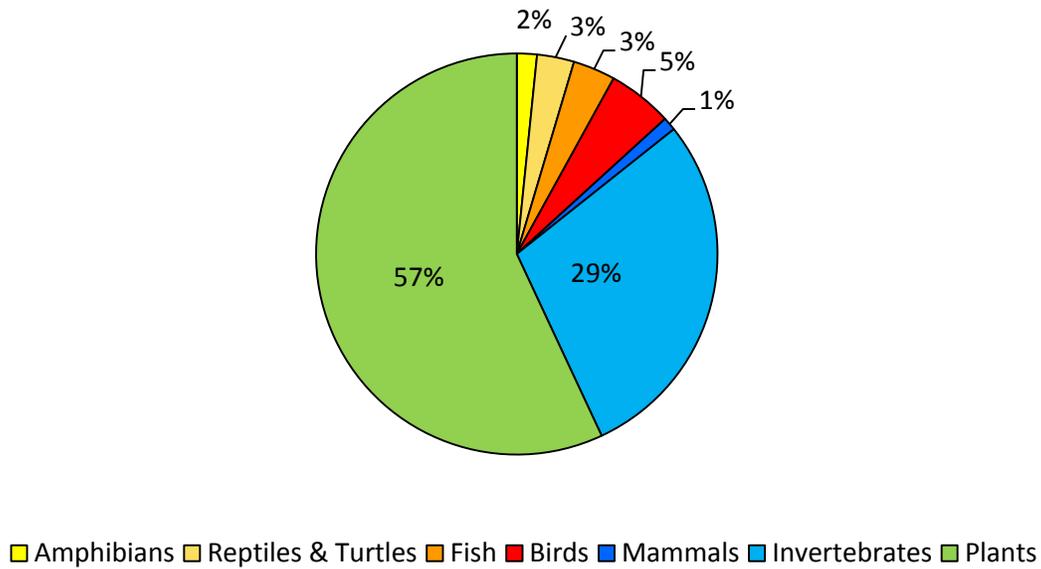
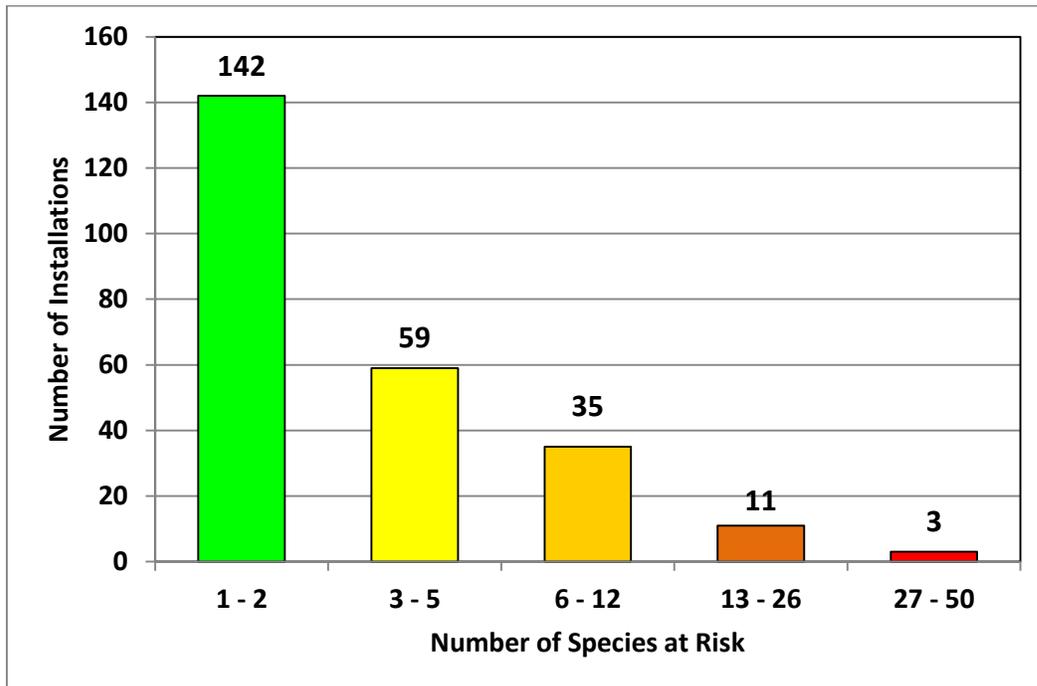


Figure 2 shows that over half of the SAR on DoD lands are plants, with invertebrates making up nearly 30% of the species on DoD lands.

4.1.2 Geography of Species at Risk

Figure 3. Number of SAR on Individual Installations



Species at Risk on DoD Installations

Figure 4a. Map depicting the number of species at risk found on DoD installations across the fifty U.S. states. The absence of data in any particular geographic area does not necessarily indicate that species at risk are not present. SOURCES: NatureServe 2014, Data.gov 2014

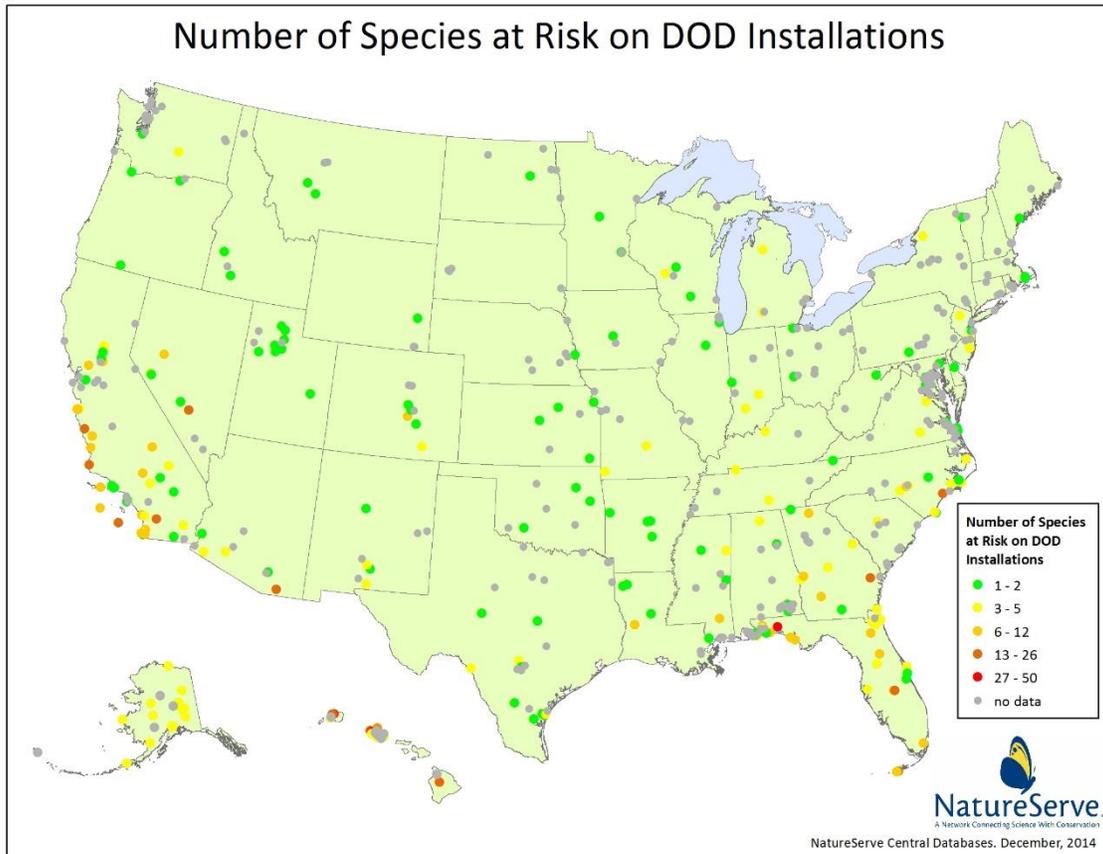
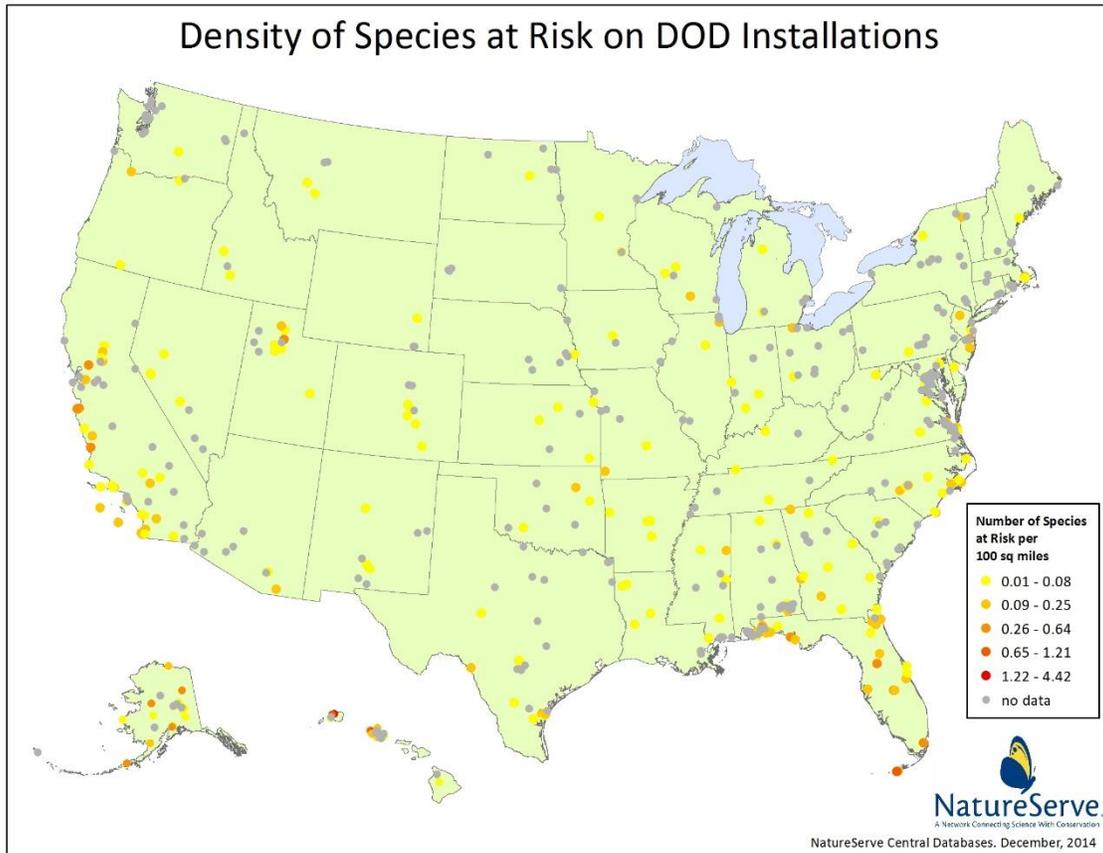


Figure 4b. Map depicting the density of at-risk species (no. species/100 square miles) occurring on DoD installations across the fifty U.S. States. The absence of data in any particular geographic area does not necessarily indicate that species at risk are not present. SOURCES: NatureServe 2014, Data.gov 2014.



4.2 Assessment of Species at Risk by Military Service

Figure 5a. Number of Species at Risk by Military Service

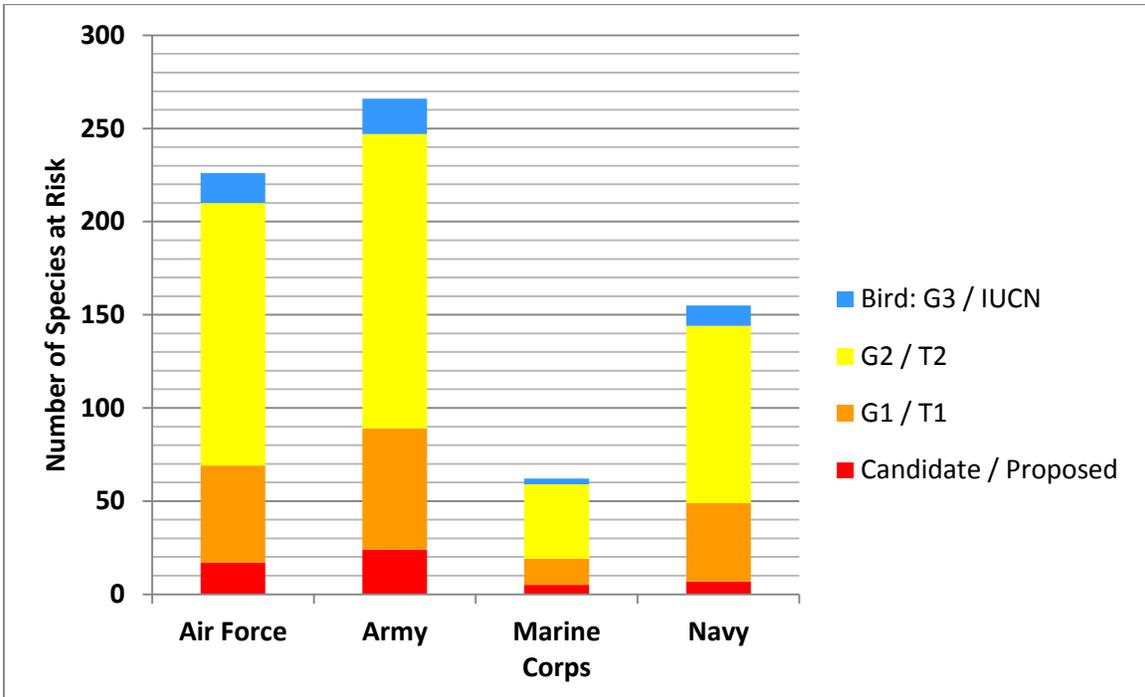
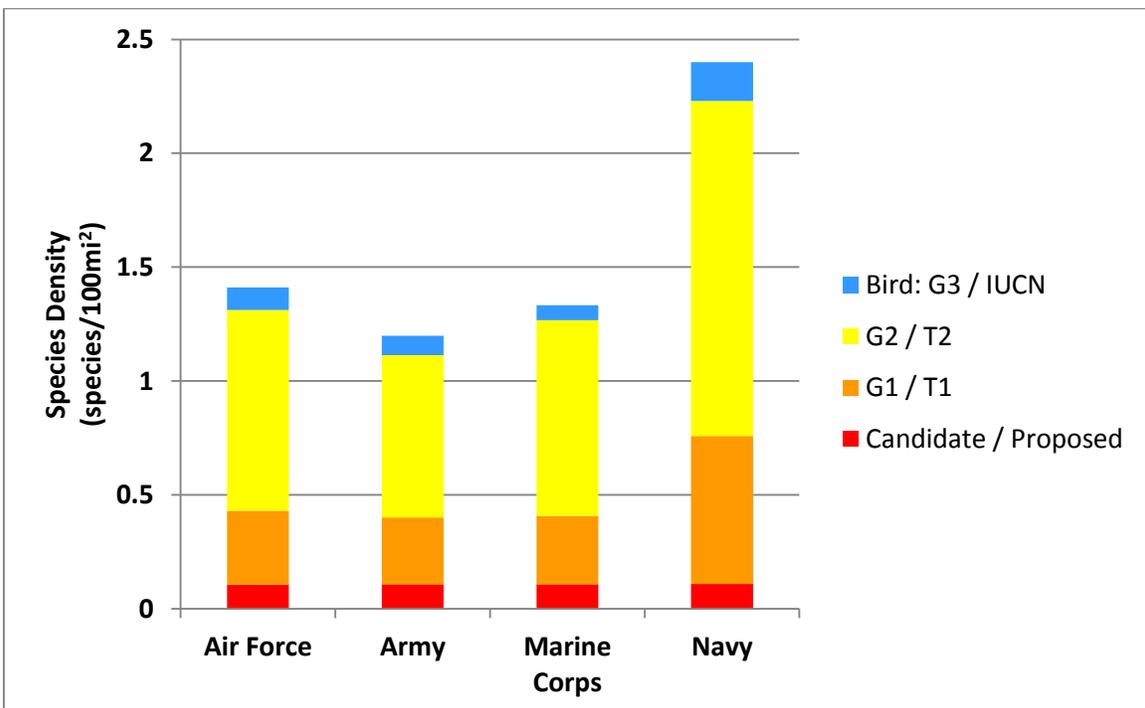


Figure 5b. Density of Species at Risk by Military Service (buffered)



4.3 Assessment of Species at Risk on Installations

4.3.1 Installation Highlights

Figure 6a. DoD Installations with the Highest Number of Species at Risk

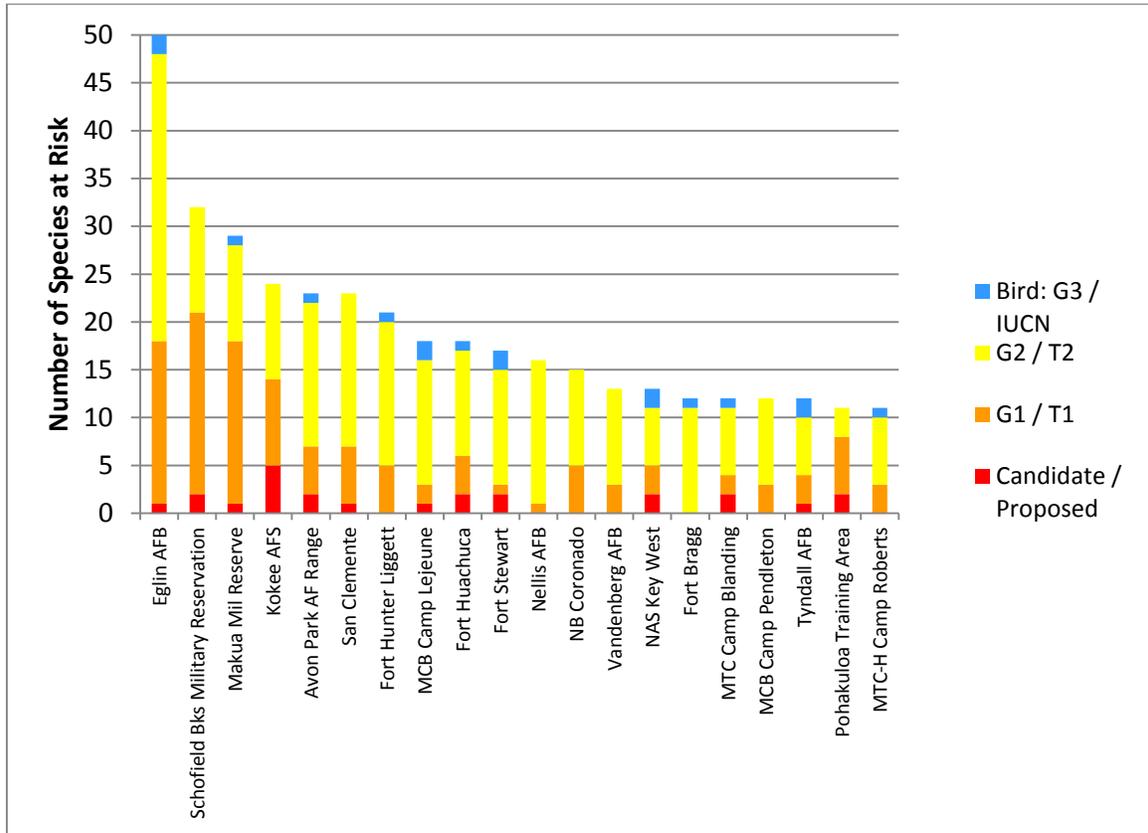


Figure 6a shows the DoD installations with the highest numbers of SAR. Many installations in biodiversity rich areas of the country come out on top, such as Florida, Hawaii, and California.

Figure 6b. DoD Installations with the Highest Density of Species at Risk

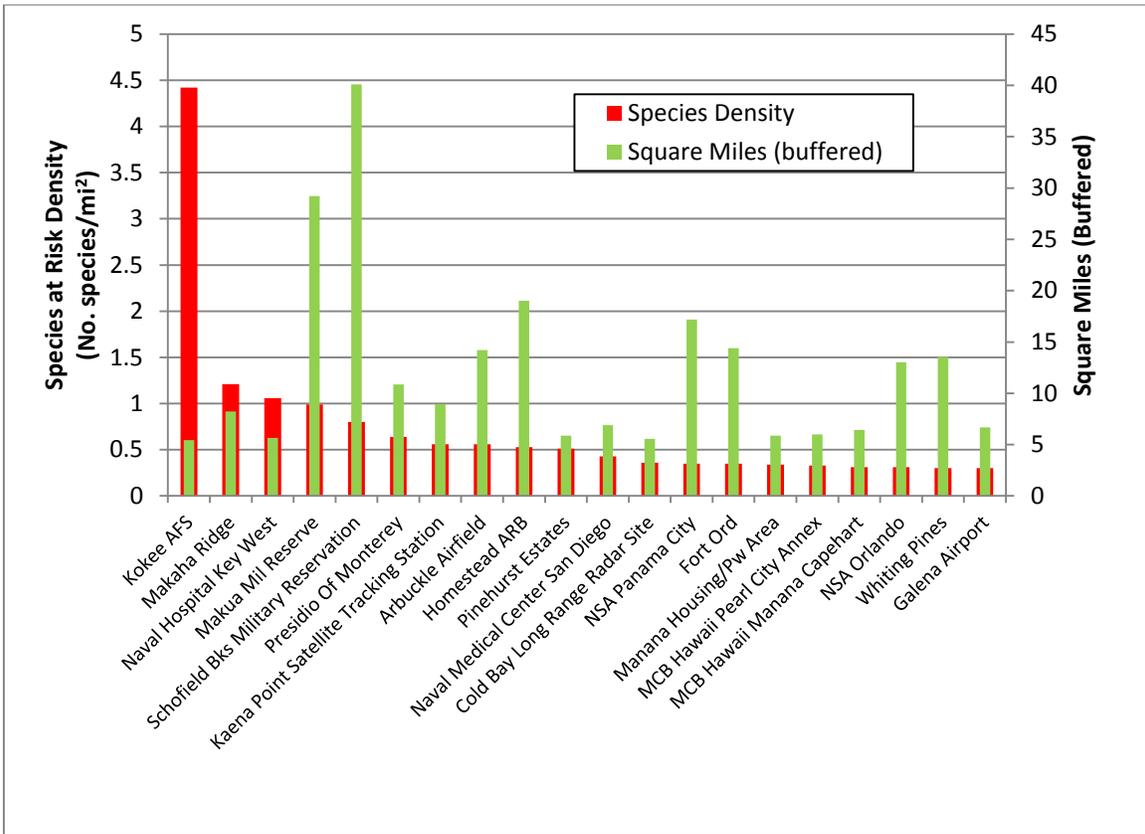


Figure 6b shows the DoD installations with the highest density of SAR. Here we see many small installations in biodiversity rich areas of the country, such as Hawaii, come out on top.

4.3.2 Species Restricted to DoD Installations

Figure 7. Numbers of species at risk in which at least 50% of all known Element Occurrences (EOs) reside in one installation.

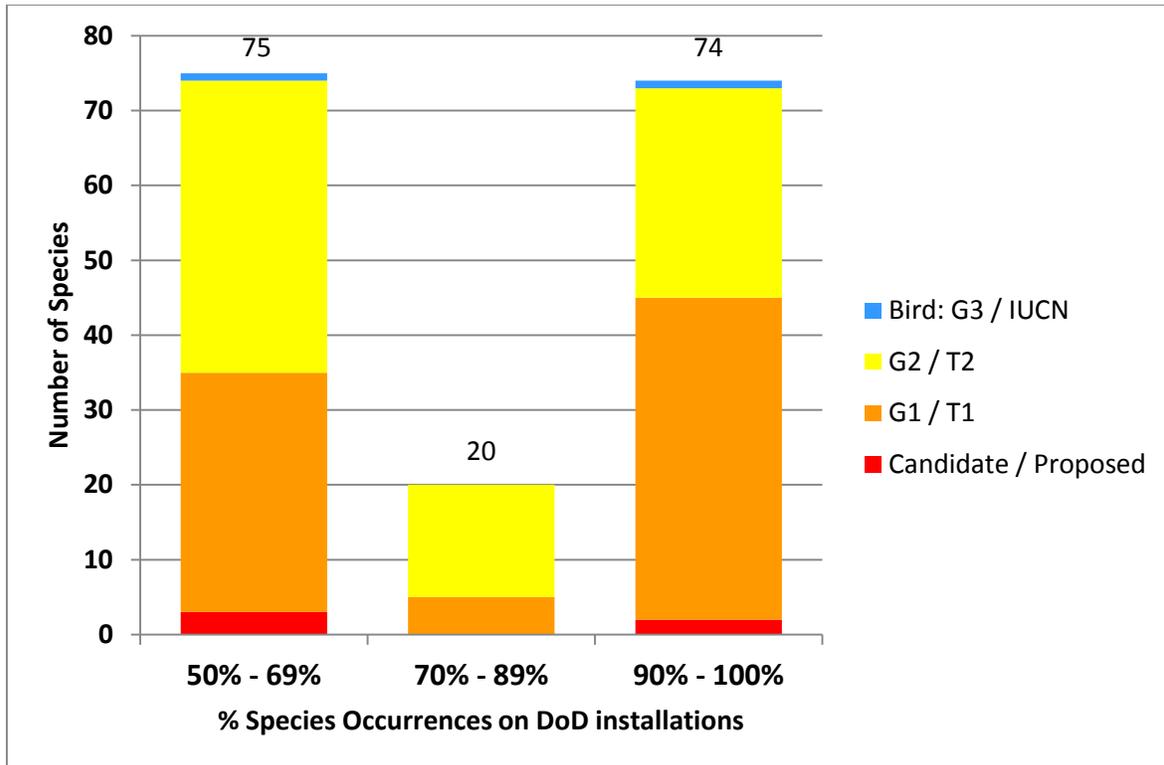


Figure 7 shows that 169 species at risk have over half of their known occurrences on a single installation. Seventy-four species have 90-100% of their known occurrences on a single installation. These species are listed below in Table 1.

Table 1. Species with 90 to 100% of known Occurrences on DoD Installations

High-level Group	Species Group	Scientific Name	Common Name	Status Group	GRANK	Rounded GRANK	USESA
Amphibians	Amphibians	LITHOBATES OKALOOSAE	FLORIDA BOG FROG	G2 / T2	G2	G2	
Birds	Birds	PHOEBASTRIA IMMUTABILIS	LAYSAN ALBATROSS	Bird: G3 / IUCN	G3	G3	
Fish	Freshwater and Anadromous Fishes	CYPRINODON TULAROSA	WHITE SANDS PUPFISH	G1 / T1	G1	G1	
Invertebrates	Amphipods	STYGOBROMUS PHREATICUS	NORTHERN VIRGINIA WELL AMPHIPOD	G1 / T1	G1	G1	

Species at Risk on DoD Installations

High-level Group	Species Group	Scientific Name	Common Name	Status Group	GRANK	Rounded GRANK	USESA
Invertebrates	Butterflies and Skippers	AGATHYMUS EVANSI	HUACHUCA GIANT-SKIPPER	G2 / T2	G2G3	G2	
Invertebrates	Caddisflies	AGARODES ZICZAC	ZIGZAG BLACKWATER CADDISFLY	G2 / T2	G2	G2	
Invertebrates	Caddisflies	CHEUMATOPSYCHE GORDONAE	GORDON'S LITTLE SISTER SEDGE	G1 / T1	G1G2	G1	
Invertebrates	Caddisflies	HYDROPTILA BRIBRIAE	KRIEBEL'S HYDROPTILA CADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	HYDROPTILA EGLINENSIS	SABERLIKE HYDROPTILA CADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	HYDROPTILA HAMILTONI	HAMILTON'S HYDROPTILA CADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	HYDROPTILA OKALOOSA	ROGUE CREEK HYDROPTILA CADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	HYDROPTILA SARAHAE	SARAH'S HYDROPTILA CADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	LEPIDOSTOMA MORSEI	MORSE'S LITTLE PLAIN BROWN SEDGE	G2 / T2	G2G3	G2	
Invertebrates	Caddisflies	NYCTIOPHYLAX MORSEI	MORSE'S DINKY LIGHT SUMMER SEDGE	G2 / T2	G2	G2	
Invertebrates	Caddisflies	OCHROTRICHIA OKALOOSA	OKALOOSA SOMBER MICROCADDISFLY	G1 / T1	G1	G1	
Invertebrates	Caddisflies	OXYETHIRA KELLEYI	KELLY'S CREAM AND BROWN MOTTLED MICROCADDISFLY	G1 / T1	G1G2	G1	
Invertebrates	Caddisflies	POLYCENTROPUS FLORIDENSIS	FLORIDA BROWN CHECKERED SUMMER SEDGE	G2 / T2	G2	G2	
Invertebrates	Crayfishes	FALLICAMBARUS GORDONI	CAMP SHELBY BURROWING CRAYFISH	G1 / T1	G1	G1	
Invertebrates	Other Beetles	POLYPHYLLA PUBESCENS	EGLIN UPLANDS SCARAB BEETLE	G1 / T1	G1G2	G1	
Invertebrates	Other Beetles	PSEUDANOPHTH ALMUS COLEMANENSIS	COLEMAN CAVE BEETLE	C / P	G1	G1	C
Invertebrates	Other Beetles	PSEUDANOPHTH ALMUS PARADOXUS	RIDGETOP CAVE BEETLE	G1 / T1	G1	G1	

Species at Risk on DoD Installations

High-level Group	Species Group	Scientific Name	Common Name	Status Group	GRANK	Rounded GRANK	USESA
Invertebrates	Other Beetles	RHYNCOGONUS GIFFARDI	GIFFARD'S RHYNCOGONUS WEEVIL	G1 / T1	G1	G1	
Invertebrates	Other Insects	PNIRONTIS BRIMLEYI	AN ASSASSIN BUG	G2 / T2	G2	G2	
Invertebrates	Other Moths	CRAMBUS DAECKELLUS	DAECKE'S PYRALID MOTH	G2 / T2	G1G3	G2	
Invertebrates	Other Moths	HELCOVERPA CONFUSA	CONFUSED HELICOVERPAN NOCTUID MOTH	G1 / T1	G1?	G1	
Invertebrates	Terrestrial Snails	AMAISTRA CYLINDRICA	AMASTRID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	AMAISTRA MICANS	AMASTRID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	AMAISTRA RUBENS	AMASTRID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	AURICULELLA AFF. PERPUSILLA N. SP. 1	ACHATINELLID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	AURICULELLA MALLEATA	ACHATINELLID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	AURICULELLA TENELLA	ACHATINELLID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	DRYACHLOA DAUCA	CARROT GLASS	G2 / T2	G2	G2	
Invertebrates	Terrestrial Snails	HELMINTHOGLYPTA MOHAVEANA	VICTORVILLE SHOULDERBAND	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	HELMINTHOGLYPTA TRASKII TRASKII	A TERRESTRIAL SNAIL	G1 / T1	G1G2T1	T1	
Invertebrates	Terrestrial Snails	LEPTACHATINA LEPIDA	AMASTRID LAND SNAIL (HAWAII)	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	LYROPUPA SP. 1	PUPILLID LAND SNAIL (LYROPUPA OR LYROPUPILLA)	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	MICRARIONTA FERLIS	SAN NICOLAS ISLANDSNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	MICRARIONTA GABBI	SAN CLEMENTE ISLANDSNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	PARTULINA DUBIA	ACHATINELLID LAND SNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	ROTHELIX WARNERFONTIS	WARNER SPRINGS SHOULDERBAND	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	SONORELLA DALLI	GARDEN CANYON TALUSSNAIL	G1 / T1	G1	G1	
Invertebrates	Terrestrial Snails	SONORELLA METCALFI	FRANKLIN MOUNTAIN TALUSSNAIL	G2 / T2	G2	G2	

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High-level Group	Species Group	Scientific Name	Common Name	Status Group	GRANK	Rounded GRANK	USESA
Invertebrates	Tiger Beetles	CICINDELA LATESIGNATA LATESIGNATA	WESTERN BEACH TIGER BEETLE	G1 / T1	G2G4T1T2	T1	
Mammals	Mammals	UROCYON LITTORALIS CLEMENTAE	SAN CLEMENTE ISLAND FOX	G1 / T1	G1T1	T1	
Mammals	Mammals	UROCYON LITTORALIS DICKEYI	SAN NICOLAS ISLAND FOX	G1 / T1	G1T1	T1	
Plants	Flowering Plants	AGERATUM LITTORALE	CAPE SABLE AGERATUM	G2 / T2	G2G3	G2	
Plants	Flowering Plants	ANCISTROCARPHUS KEILII	SANTA YNEZ GROUNDSTAR	G1 / T1	G1	G1	
Plants	Flowering Plants	ARCTOSTAPHYLOS PUMILA	SANDMAT MANZANITA	G2 / T2	G2	G2	
Plants	Flowering Plants	BOURRERIA RADULA	ROUGH STRONGBARK	G2 / T2	G2?	G2	
Plants	Flowering Plants	BRODIAEA KINKIENSIS	SAN CLEMENTE ISLAND BRODIAEA	G2 / T2	G2	G2	
Plants	Flowering Plants	CALYCANTHUS BROCKIANA	BROCK SWEETSHRUB	G1 / T1	G1?Q	G1	
Plants	Flowering Plants	CRYPTANTHA TRASKIAE	TRASK'S CRYPTANTHA	G2 / T2	G2	G2	
Plants	Flowering Plants	DUDLEYA VIRENS SSP. VIRENS	BRIGHT GREEN DUDLEYA	G1 / T1	G2?T1	T1	
Plants	Flowering Plants	ERIGERON LEMMONII	LEMMON'S FLEABANE	G1 / T1	G1	G1	
Plants	Flowering Plants	ERIOGONUM GIGANTEUM VAR. FORMOSUM	SAN CLEMENTE ISLAND BUCKWHEAT	G2 / T2	G2T2	T2	
Plants	Flowering Plants	ERYNGIUM PENDLETONENSE	PENDLETON'S ERYNGO	G1 / T1	G1	G1	
Plants	Flowering Plants	FESTUCA HAWAIIENSIS	HAWAIIAN FESCUE	C / P	G1	G1	C
Plants	Flowering Plants	GAMBELIA SPECIOSA	SHOWY ISLAND SNAPDRAGON	G2 / T2	G2	G2	
Plants	Flowering Plants	HAZARDIA CANA	SAN CLEMENTE ISLAND HAZARDIA	G2 / T2	G2	G2	
Plants	Flowering Plants	LOMATIUM INSULARE	SAN NICOLAS ISLAND LOMATIUM	G2 / T2	G2G3	G2	
Plants	Flowering Plants	LUPINUS GUADALUPENSIS	GUADALUPE ISLAND LUPINE	G2 / T2	G2	G2	
Plants	Flowering Plants	LYONOTHAMNUS FLORIBUNDUS SSP. ASPLENIIFOLIUS	FERNLEAF IRONWOOD	G2 / T2	G2T2	T2	
Plants	Flowering Plants	MELICOPE SANDWICENSIS	GRAY'S PELEA	G2 / T2	G2	G2	

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High-level Group	Species Group	Scientific Name	Common Name	Status Group	GRANK	Rounded GRANK	USES A
Plants	Flowering Plants	NERAUDIA KAUAIENSIS	KAUAI NERAUDIA	G1 / T1	G1	G1	
Plants	Flowering Plants	NOTOTRICHUM DIVARICATUM	NA PALI ROCKWORT	G1 / T1	G1	G1	
Plants	Flowering Plants	PERITYLE HUECOENSIS	HUECO MOUNTAINS ROCKDAISY	G1 / T1	G1	G1	
Plants	Flowering Plants	PHACELIA FLORIBUNDA	ISLAND PHACELIA	G2 / T2	G2	G2	
Plants	Flowering Plants	POGOGYNE CLAREANA	SANTA LUCIA POGOGYNE	G2 / T2	G2	G2	
Plants	Flowering Plants	RUBUS HANCINIANUS	SALINA DEWBERRY	G2 / T2	G2	G2	
Plants	Flowering Plants	STEPHANOMERIA BLAIRII	BLAIR'S MUNZOTHAMNUS	G2 / T2	G2	G2	
Plants	Flowering Plants	STIPA SHOSHONEANA		G2 / T2	G2G3	G2	
Plants	Flowering Plants	TETRAMOLOPIUM SP. 1		G1 / T1	G1	G1	
Plants	Flowering Plants	TRITELEIA CLEMENTINA	SAN CLEMENTE ISLAND TRITELEIA	G2 / T2	G2	G2	
Plants	Lichens	MOBERGIA CALCULIFORMIS	LIGHT GRAY LICHEN	G1 / T1	G1	G1	

5.0 Appendices

5.1 Metadata

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Appendix 5.1a. Data Use Suggestions and Guidelines

The information about species at risk on military bases is provided to the Department of Defense (DoD) for planning, assessment, and informational purposes. NatureServe reserves all rights in data provided.

This is intended as an initial coarse filter to help identify and prioritize conservation efforts for species at risk on or near DoD installations on a national level. The analyses and reports described in the next section can be used, for example, to identify installations that have a significant number of conservation targets or to identify species that are known to occur mostly on DoD lands. In both cases, conservation efforts by the DoD would have a major impact on protecting biodiversity in the United States.

The data presented in these analyses, however, should not be considered a definitive statement on the presence, absence, or condition of biological elements at any given location. The lack of data for any installation cannot be construed to mean that no species at risk or other significant features are present. Installation-specific projects or activities should be reviewed for potential environmental impacts with appropriate regulatory agencies. It is suggested that the appropriate state natural heritage program(s) be contacted for a site-specific review of the area and/or for input on the creation of management plans. For natural heritage program contact information, please see the NatureServe web site: <http://www.natureserve.org/>.

Distribution of the complete data set or subsets of the species at risk data to other than agreed upon parties, or posting of these data in whole or in part on any public computer network may only be done with prior written permission of NatureServe. All parties receiving these data must be informed of these restrictions.

Please provide appropriate and mutually agreed acknowledgment of NatureServe and as data contributors to any reports or other products derived from this data. The

following citation and acknowledgement statement should be used. As appropriate, NatureServe's logo should also be used on publications or other products where NatureServe contributed data or information.

Citation:

NatureServe. 2015. NatureServe Central Databases. Arlington, VA. U.S.A.

As your time permits, please note any errors or omissions that you find in the data. Such comments will be valuable in improving the quality of our databases for the network of users.

Appendix 5.1b. NatureServe Data Completeness, Quality, and Currentness

Completeness

The completeness of NatureServe data varies between species. NatureServe data is particularly strong and very complete in tracking the terrestrial and freshwater vertebrate species, vascular plants, and entities with status under the U.S. Endangered Species Act (ESA). Many invertebrate groups are completely tracked, but the databases on these elements continue to expand. The non-vascular plant data (lichens, mosses, liverworts & hornworts, fungi) are being actively developed and element occurrences of these groups will expand over the next few years. Marine species, even in coastal areas are not completely tracked and documented with element occurrences, however this varies across member programs

Note that data for Native American tribal lands are not available for most western states.

NatureServe conducted analyses on all available data that met the criteria for the project as described above.

Quality, Currentness and Updates

All the data fields which are considered necessary for the DoD species at risk analyses have been quality controlled either by the individual member program or NatureServe staff to meet minimum standards for spatial representation, taxonomy and status as defined below:

- **Conservation Status Ranks:** NatureServe has conducted quality control checks to assure that the local, national and global status information are consistent for the element range-wide.
- **Federal Status Designations:** NatureServe staff update the central databases with changes in status due to proposals and determinations to add taxa to the

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Lists of Endangered and Threatened Wildlife and Plants within two weeks of publication in the Federal Register. Addition and removal of candidates in Notices of Review or Notices of Reclassification are entered within four weeks of their publication. Where species have a partial or mixed federal status designation, the correct federal status has been assigned at the element occurrence level and only those occurrence records that are federally listed have been provided.

- **Taxonomy:** NatureServe is constantly updating taxonomic information based on the publication of new sources. See Appendix 5.1f for information about taxonomic procedures and a current list of sources for all taxonomic groups potentially included in the dataset.
- **Spatial Data:** All element occurrence records are mapped as accurately as recorded by member programs. Element occurrence (EO) locations are either (a) plotted manually on 1:24,000 USGS topographical maps and the coordinates are calculated in latitude and longitude using a map overlay; or (b) mapped in GIS using the Biotics Mapper tool. Spatial data are updated and reviewed by the member programs on an ongoing basis. Any Element Occurrences known to be incorrectly identified or mapped have been excluded

Appendix 5.1c. Data Exchange Cycle and Data Upload

NatureServe's Central Database is linked to all the U.S. and Canadian databases of the Natural Heritage Program and Conservation Data Centre member programs through a process of regular annual data exchange and reconciliation. Member programs send their data to NatureServe Central for taxonomic and status reconciliation on approximately an annual schedule. If necessary, incoming member program datasets are converted from their native file format to a format that is compatible with the NatureServe Central Databases, and GIS files of Element Occurrences are reprojected to a common projection. NatureServe Central Databases are updated with the latest scientific information developed by the member programs at the state and provincial scale, including updated Element Occurrence data. In return, member program databases are updated with the latest scientific information developed at the global scale by NatureServe Central. The data exchange and reconciliation process is a primary mechanism by which network data standards are upheld, thus helping to ensure a high level of accuracy, currency and quality to the data.

Appendix 5.1d. U.S. Endangered Species Act Status: Data Management Procedures

Listings under the U.S. Endangered Species Act

The U.S. Endangered Species Act (U.S. ESA) is the primary legislation that affords federal legal protections to threatened and endangered species in the United States, and is administered by the U.S. Fish and Wildlife Service (USFWS) (<http://www.fws.gov/endangered/>) and U.S. National Marine Fisheries Service (NMFS) (<http://www.nmfs.noaa.gov/pr/species/>). As defined by the Act, endangered refers to species that are "in danger of extinction within the foreseeable future throughout all or a significant portion of its range," while threatened refers to "those animals and plants likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges." Plant species and varieties (including fungi and lichens), animal species and subspecies, and vertebrate animal populations are eligible for listing under the Act.

Status under the U.S. Endangered Species Act provided by NatureServe is based on formal notices published by USFWS or NMFS in the Federal Register. The date shown alongside the status refers to the formal Federal Register publication date regarding the status designation. Dates appear only for taxa and populations that are specifically named in a Federal Register Notice of Review Table or in the section of a Federal Register Proposed or Final Rule that proposes or declares an amendment to 50 Code of Federal Regulations Part 17 Section 11 or 12 (i.e., changes to the Lists of Endangered and Threatened Wildlife and Plants).

Specifically, dates represent:

- For listed endangered and threatened taxa and populations: the date of publication of the Federal Register "Final Rule" for the taxon or population.
- For proposed taxa and populations: the date of publication of the most recent Federal Register "Proposed Rule" for the taxon or population.
- For candidate taxa and populations: the date of publication of the most recent "Notice of Reclassification" or "Notice of Review" in which the candidate appears.

NatureServe staff regularly update the central databases with changes in status due to proposals and determinations to add taxa to the Lists of Endangered and Threatened Wildlife and Plants as published in the Federal Register. Addition and removal of candidates in Notices of Review or Notices of Reclassification are entered after publication in the Federal Register.

ESA Status Definitions in NatureServe datasets

NatureServe generally uses the same scientific name as USFWS for species with status under the Endangered Species Act. For listed population segments of vertebrate animals, NatureServe information can typically be found in the species record associated with the subspecies or population. Where names used by the USFWS differ from those used by NatureServe, NatureServe records are cross-referenced and can be

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found using either name. The following table provides abbreviations and definitions for various listing statuses under the U.S. Endangered Species Act.

U.S. Endangered Species Act Abbreviations	
NatureServe Abbreviation	Status Under the U.S. Endangered Species Act
LE	Listed endangered
LT	Listed threatened
PE	Proposed endangered
PT	Proposed threatened
C	Candidate
SC	Species of Concern
PDL	Proposed for delisting
SAE or SAT	Listed endangered or threatened because of similarity of appearance
PSAE or PSAT	Proposed endangered or threatened because of similarity of appearance
XE	Essential experimental population
XN	Nonessential experimental population
Null value	Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in the central databases and refresh of this website, some taxa may have a status which does not yet appear.

Status Due to Taxonomic Relationship ("Implied USESA Status")

In some cases species or infraspecific taxa may not be named in a federal register notice, but may still have federal protection due to their taxonomic relationship with formally listed taxa. Section 17.11(g) of the Endangered Species Act states, "the listing of a particular taxon includes all lower taxonomic units." Also, if an infraspecific taxon or population has federal status, then by default, some part of the species has federal protection. NatureServe notes where federal protection of a taxon is "implied" through such taxonomic relationships. Where federal status is implied due to a taxonomic relationship alone, no date of listing is given.

Status of Geopolitically or Administratively Defined Populations

Distinct population segments of vertebrate animals may be listed as threatened or endangered under the Endangered Species Act. Listed populations may be defined by geopolitical boundaries (i.e., the status applies to the species or subspecies only within those boundaries, even though the taxon may range more broadly), or populations may be defined administratively (e.g., experimental populations). Because such populations do not typically have individual records in NatureServe databases, the U.S. ESA status is recorded for the species or subspecies to which that population belongs. In these cases, the status abbreviation appears after the abbreviation "PS" for "partial status" - indicating that the status applies only to a portion of the species' range.

Implied ESA Status Notations (Status Due to Taxonomic Relationship)		
Example	Explanation	Definition
<i>value (date)</i>	Basic value	The taxon is named in the Federal Register and has one status.
<i>Value, Value(date)</i>	Combination Values (U.S. ESA)	The taxon has one status currently, but a more recent proposal has been made to change that status with no final action yet published. For example, "LE, PDL" indicates that the species is currently listed as endangered, but has been proposed for delisting. Or, the taxon has two or more different statuses throughout its range. More specifically, it has a status in one portion of its range and one or more different statuses in the remainder of its range. The date corresponds to the first listed value.

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Value	Flagged Values (Implied U.S. ESA)	The taxon itself is not named in the Federal Register as having U.S. ESA status; however, it does have U.S. ESA status as a result of its taxonomic relationship to a named entity. For example, if a species is federally listed as endangered, then by default, all of its recognized subspecies also have endangered status. The subspecies in this example would have the value "LE (1)" under U.S. ESA Status. Likewise, if all of a species' infraspecific taxa (rangewide) have the same U.S. ESA status, then that status appears in the record for the "full" species as well. In this case, if the taxon at the species level is not mentioned in the Federal Register. In the case of full species records where at least one but not all of the species' infraspecific taxa or populations has U.S. ESA status, the full species will be listed as having "Partial Status"; see below.
<i>Value, Value</i>	Combination flagged values (Implied U.S. ESA)	The taxon itself is not named in the Federal Register as having U.S. ESA status; however, all of its infraspecific taxa (rangewide) have official status but two or more of the taxa do not have the same status. In this case, a combination of the statuses shown with a flag (7) indicates the statuses that apply to infraspecific taxa or populations within this taxon.
PS	Partial Status (Implied U.S. ESA)	Indicates "partial status"—status in only a portion of the species' range. Typically indicated in a "full" species record where at least one but not all of a species' infraspecific taxa or populations has U.S. ESA status.
<i>PS:Value</i>	Partial Status (Implied U.S. ESA)	Indicates "partial status"—status in only a portion of the species' range. The value of that status appears because the listed entity (usually a population defined by geopolitical boundaries or defined administratively, such as experimental

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		populations) does not have an individual entry in NatureServe data. Information about the listed entity can be found in reports for the associated species.
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Appendix 5.1e. NatureServe Conservation Status Ranks

Listed below are definitions for interpreting NatureServe global (rangewide) conservation status ranks. These ranks are assigned by NatureServe scientists or by a designated lead office in the NatureServe network.

Global (G) Conservation Status Ranks

Rank	Definition
GX	<p>Presumed Extinct (species)— Not located despite intensive searches and virtually no likelihood of rediscovery.</p> <p>Eliminated (ecological communities)—Eliminated throughout its range, with no restoration potential due to extinction of dominant or characteristic taxa and/or elimination of the sites and disturbance factors on which the type depends.</p>
GH	<p>Possibly Extinct (species) Eliminated (ecological communities and systems) — Known from only historical occurrences but still some hope of rediscovery. There is evidence that the species may be extinct or the ecosystem may be eliminated throughout its range, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is extinct or eliminated throughout its range.¹</p>
G1	<p>Critically Imperiled—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.</p>
G2	<p>Imperiled—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.</p>
G3	<p>Vulnerable—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.</p>
G4	<p>Apparently Secure—Uncommon but not rare; some cause for long-term concern due to declines or other factors.</p>
G5	<p>Secure—Common; widespread and abundant.</p>

¹ Possibly Eliminated ecological communities and systems may include ones presumed eliminated throughout their range, with no or virtually no likelihood of rediscovery, but with the potential for restoration, for example, American Chestnut (Forest).

Variant Ranks

Rank	Definition
G#G#	Range Rank —A numeric range rank (e.g., G2G3, G1G3) is used to indicate the range of uncertainty about the exact status of a taxon or ecosystem type. Ranges cannot skip more than two ranks (e.g., GU should be used rather than G1G4).
GU	Unrankable —Currently unrankable due to lack of information or due to substantially conflicting information about status or trends. NOTE: Whenever possible (when the range of uncertainty is three consecutive ranks or less), a range rank (e.g., G2G3) should be used to delineate the limits (range) of uncertainty.
GNR	Unranked —Global rank not yet assessed.
GNA	Not Applicable —A conservation status rank is not applicable because the species is not a suitable target for conservation activities. ²

² A global conservation status rank may be not applicable for several reasons, related to its relevance as a conservation target. In such cases, typically the species is a hybrid without conservation value, of domestic origin, or the ecosystem is non-native, for example, ruderal vegetation, a plantation, agricultural field, or developed vegetation (lawns, gardens etc).

Rank Qualifiers

Rank	Definition
?	Inexact Numeric Rank —Denotes inexact numeric rank; this should not be used with any of the Variant Global Conservation Status Ranks or GX or GH.
Q	Questionable taxonomy that may reduce conservation priority —Distinctiveness of this entity as a taxon or ecosystem type at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon or type in another taxon or type, with the resulting taxon having a lower-priority (numerically higher) conservation status rank. The “Q” modifier is only used at a global level and not at a national or subnational level.
C	Captive or Cultivated Only —Taxon at present is extinct in the wild across their entire native range but is extant in cultivation, in captivity, as a naturalized population (or populations) outside their native range, or as a reintroduced population not yet established. The “C” modifier is only used

	at a global level and not at a national or subnational level. Possible ranks are GXC or GHC.
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Intraspecific Taxon Conservation Status Ranks

Intraspecific taxa refer to subspecies, varieties and other designations below the level of the species. Intraspecific taxon status ranks (T-ranks) apply to plants and animal species only; these T-ranks do not apply to ecological communities.

Rank	Definition
T#	Intraspecific Taxon (trinomial) —The status of intraspecific taxa (subspecies or varieties) are indicated by a “T-rank” following the species' global rank. Rules for assigning T-ranks follow the same principles outlined above. For example, the global rank of a critically imperiled subspecies of an otherwise widespread and common species would be G5T1. A T subrank cannot imply the subspecies or variety is more abundant than the species . For example, a G1T2 subrank should not occur. A vertebrate animal population, (e.g., listed under the U.S. Endangered Species Act or assigned candidate status) may be tracked as an intraspecific taxon and given a T-rank; in such cases a Q is used after the T-rank to denote the taxon's informal taxonomic status.

National and Subnational Conservation Status Definitions

Listed below are definitions for interpreting NatureServe conservation status ranks at the national (N-rank) and subnational (S-rank) levels. The term "subnational" refers to state or province-level jurisdictions (e.g., California, Ontario).

Assigning national and subnational conservation status ranks for species and ecosystems follows the same general principles as used in assigning global status ranks. A subnational rank, however, cannot imply that the species or ecosystem is more secure at the state/province level than it is nationally or globally (i.e., a rank of G1S3 is invalid), and similarly, a national rank cannot exceed the global rank. Subnational ranks are assigned and maintained by state or provincial NatureServe network programs.

National (N) and Subnational (S) Conservation Status Ranks

Status	Definition
NX SX	Presumed Extirpated —Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

NH SH	Possibly Extirpated — Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.
N1 S1	Critically Imperiled —Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.
N2 S2	Imperiled —Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.
N3 S3	Vulnerable —Vulnerable in the jurisdiction due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.
N4 S4	Apparently Secure —Uncommon but not rare; some cause for long-term concern due to declines or other factors.
N5 S5	Secure —Common, widespread, and abundant in the jurisdiction.

Variant National and Subnational Conservation Status Ranks

Rank	Definition
N#N# S#S#	Range Rank — A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
NU SU	Unrankable —Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
NNR SNR	Unranked —National or subnational conservation status not yet assessed.
NNA SNA	Not Applicable —A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities. ³

Species at Risk on DoD Installations

Not Provided	Species or ecosystem is known to occur in this nation or state/province. Contact the relevant NatureServe network program for assignment of conservation status.
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³ A conservation status rank may be not applicable for some species, including long distance aerial and aquatic migrants, hybrids without conservation value, and non-native species or ecosystems, for several reasons, described below.

Long distance migrants: Assigning conservation status to long distance aerial or aquatic migrant animals (e.g., species like migrant birds, bats, butterflies, sea turtles, and cetaceans) during their migrations is typically neither practical nor helpful to their conservation. During their migrations, most long distance migrants occur in an irregular, transitory, and dispersed manner. Some long distance migrants occur regularly, while others occur only as accidental or casual visitors to a subnation or nation. Some long distance migrants may regularly occur as rare breeding or nonbreeding seasonal (e.g., winter) species, but in an inconsistent, spatially irregular fashion, or as breeders that die out apparently with no return migration and no overwintering (e.g., some Lepidoptera). In all these circumstances, it is not possible to identify discrete areas for individual species that can be managed so as to significantly affect their conservation in a nation or subnation. The risk of extinction for these species is largely dependent on effective conservation of their primary breeding and nonbreeding grounds, notwithstanding actions that may benefit species collectively such as protecting migratory “hotspots,” curbing pollution, minimizing deaths from towers and other obstructions, etc.

Hybrids without conservation value and non-natives: It is not appropriate to assign a conservation status to hybrids without conservation value, or to non-native species or ecosystems. However, in the rare case where a species is presumed or possibly extinct in the wild (GXC/GHC) but is extant as a naturalized population outside of its native range, the naturalized population should be treated as a benign introduction, and should be assessed and assigned a numeric national and/or subnational conservation status rank. The rationale for this exception for naturalized populations is that when a species is extinct over its entire natural range, the presence of that species within an area must be considered important to highlight and preserve, even if the area is not part of the species’ natural range.

Rank Qualifier

Rank	Definition
N#? S#?	Inexact Numeric Rank —Denotes inexact numeric rank. This designation should not be used with any of the variant national or subnational conservation status ranks or NX, SX, NH, or SH.

Breeding Status Qualifiers⁴

Species at Risk on DoD Installations

Qualifier	Definition
B	Breeding —Conservation status refers to the breeding population of the species in the nation or state/province.
N	Nonbreeding —Conservation status refers to the non-breeding population of the species in the nation or state/province.
M	Migrant —Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

⁴ A breeding status is only used for species that have distinct breeding and/or non-breeding populations in the nation or state/province. A breeding-status S-rank can be coupled with its complementary non-breeding-status S-rank if the species also winters in the nation or state/province. In addition, a breeding-status S-rank can also be coupled with a migrant-status S-rank if, on migration, the species occurs regularly at particular staging areas or concentration spots where it might warrant conservation attention. Multiple conservation status ranks (typically two, or rarely three) are separated by commas (e.g., S2B,S3N or SHN,S4B,S1M).

Appendix 5.1g. Standard Global Taxonomic Sources

NatureServe scientists use a set of generally accepted references, augmented by recent scientific literature and expert opinion, to establish a standard "global" scientific name and taxon circumscription (that is, the name for the biological entity) for every element (plant, animal, or ecological community and system) tracked in the NatureServe Central Databases.

CLASSIFICATION OF PLANTS

NatureServe's standard references represent the consensus standards for researchers working in a given geographic area. Plant and lichen taxa newly described in the published scientific literature after the publication of the relevant standard reference (i.e. taxa neither accepted nor rejected by the standard) are also included if they have a validly published scientific name. NatureServe also includes plant and lichen names not accepted in the standard reference that have status assigned under the U.S. Endangered Species Act or by the Committee on the Status of Endangered Wildlife in Canada. Selected non-lichenized fungi are described by a variety of credible sources rather than a single standard reference.

I. Standard References for Vascular Plants

Records are currently being revised in accordance with:

Kartesz, J.T. 1999. A synonymized checklist and atlas with biological attributes for the vascular flora of the United States, Canada, and Greenland. First edition. In: Kartesz, JT and CA Meacham. Synthesis of the North American flora [computer program]. Version 1.0. North Carolina Botanical Garden: Chapel Hill, NC.

Records not yet revised were classified in accordance with:

Kartesz J.T. 1994. A synonymized checklist of the vascular flora of the United States, Canada, and Greenland. 2nd ed. 2 vols. Portland, (OR): Timber Press.

II. Standard References for Nonvascular Plants and Lichens

Anderson L.E., Crum H.A., Buck W.R. 1990. List of the mosses of North America north of Mexico. *The Bryologist* 93(4):448-499.

Anderson L.E. 1990. A checklist of sphagnum in North America north of Mexico. *The Bryologist* 93(4):500-501.

Esslinger T.L., Egan R.S. 1995. A sixth checklist of the lichen-forming, lichenicolous, and allied fungi of the continental United States and Canada. *The Bryologist* 98(4):467-549.

Stotler R., Crandall-Stotler B. 1977. A checklist of the liverworts and hornworts of North America. *The Bryologist* 80(3):405-428.

Stotler, R. E. and B. Crandall-Stotler. 2005. A revised classification of the Anthocerotophyta and a checklist of the Hornworts of North America, north of Mexico. *Bryologist* 108(1): 16-26.

CLASSIFICATION OF VERTEBRATES AND INVERTEBRATES

NatureServe zoologists use a set of major references generally accepted by researchers working on a given taxonomic group. However, many of these major references are updated infrequently. Because taxonomy is a dynamic field, NatureServe zoologists review numerous journals and monographs each year for taxonomic and nomenclatural changes, and they may accept these changes before the major source(s) for each group are updated to reflect them. In addition, undescribed taxa of conservation concern (i.e., taxa for which scientific names have not yet been published) may be tracked in the NatureServe Central Databases. The process of incorporating taxonomic and nomenclatural updates from the most recent of these references into NatureServe's databases is still ongoing.

Major References for Vertebrate and Invertebrate Names and Taxonomy Used for Animals in the Natural Heritage Network (December 2011)

I. Higher Taxonomy

Phyla and Subphyla:

- Integrated Taxonomic Information System. Integrated Taxonomic Information System: Biological Names. Available online at: <http://www.itis.gov>.
- Margulis, L., and K. V. Schwartz. 1998. *Five kingdoms: An Illustrated Guide to the Phyla of Life on Earth*. Third edition. W. H. Freeman and Company, New York. 520 pp.

II. Phylum Craniata (Vertebrates)

Class Mammalia (Mammals)

- American Society of Mammalogists. Mammalian species. Cumulative index available online: <http://www.science.smith.edu/departments/Biology/VHAYSEN/msi/default.html> [ASM publishes 20-30 species accounts each year; each summarizes the current understanding of a species' biology.]

Species at Risk on DoD Installations

- Baker, R. J., L. C. Bradley, R. D. Bradley, J. W. Dragoo, M. D. Engstrom, R. S. Hoffman, C. A. Jones, F. Reid, D. W. Rice, and C. Jones. 2003. Revised checklist of North American mammals north of Mexico, 2003. Museum of Texas Tech University Occasional Papers 229:1-23.
- Da Fonseca, G., G. Herrmann, Y. Leite, R. Mittermeier, A. Rylands, and J. L. Patton. 1996. Lista anotada dos mamíferos do Brasil. Conservation International, Washington, D.C.
- Hall, E. R. 1981. The Mammals of North America. Second edition. John Wiley & Sons, New York. [Used for North American mammal subspecies names, within the framework of the species classification of the major sources cited here.]
- Reid, F. A. 1997. A field guide to the mammals of Central America and southern Mexico. Oxford University Press, New York.
- Wilson, D. E., and F. R. Cole. 2000. Common names of mammals of the world. Smithsonian Institution Press, Washington, D.C.
- Wilson, D. E., and D. M. Reeder (editors). 2005. Mammal species of the world: a taxonomic and geographic reference. Third edition. The Johns Hopkins University Press, Baltimore. Two volumes. 2,142 pp. Available online at: <http://www.bucknell.edu/msw3/>.

Class Aves (Birds)

- American Ornithologists' Union. 1957. Checklist of North American birds. Fifth edition. Port City Press, Inc., Baltimore, Maryland. [Used for North American bird subspecies names, within the framework of the species classification in AOU checklist.]
- American Ornithologists' Union (AOU). 1998. Check-list of North American birds. Seventh edition. American Ornithologists' Union, Washington, D.C. [as modified by subsequent supplements and corrections published in *The Auk*]. Also available online: <http://www.aou.org/>.
- The Birds of North America Online. Available at: <http://bna.birds.cornell.edu/BNA/>. [subscription required]
- Howard, R. and A. Moore. 2003. A complete checklist of the birds of the world. Third edition. Princeton University Press, Princeton, New Jersey. 1039 pp.
- Remsen, J. V., Jr., A. Jaramillo, M. Nores, M. B. Robbins, T. S. Schulenberg, F. G. Stiles, J. M. C. da Silva, D. F. Stotz, and K. J. Zimmer. Version [11 November 2011]. A classification of the bird species of South America. American Ornithologists' Union. <http://www.museum.lsu.edu/~Remsen/SACCBaseline.html>.

Classes Chelonia, Crocodylia, and Reptilia (Turtles, Crocodylians, and Reptiles)

- Collins, J. T., S. L. Collins, and T. W. Taggart. 2010. Amphibians, reptiles, and turtles in Kansas. Eagle Mountain Publishing, Eagle Mountain, Utah. xvi +312 pp.

Species at Risk on DoD Installations

- Crother, B. I. (editor). 2008. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Sixth edition. Society for the Study of Amphibians and Reptiles Herpetological Circular 37:1-84.
- Ernst, C. H., and R. W. Barbour. 1989. *Turtles of the world*. Smithsonian Institution Press, Washington, D.C.
- Ernst, C. H., R. W. Barbour, and J. E. Lovich. 1994. *Turtles of the United States and Canada*. Smithsonian Institution Press, Washington, D.C.
- Ernst, C. H., and E. M. Ernst. 2003. *Snakes of the United States and Canada*. Smithsonian Books, Washington, D.C.
- Iverson, J. B. 1992. A revised checklist with distribution maps of the turtles of the world. Privately printed, Earlham, Indiana.
- King, F. W., and R. L. Burke, editors. 1989. *Crocodylian, tuatara, and turtle species of the world: a taxonomic and geographic reference*. Association of Systematics Collections, Washington, D.C. 216 pp.
- McDiarmid, R. W., J. A. Campbell, and T. A. Touré. 1999. *Snake species of the world: a taxonomic and geographic reference*. Volume 1. The Herpetologists' League, Washington, D.C.
- Schwartz, A., and R.W. Henderson. 1988. *West Indian amphibians and reptiles: a check-list*. Milwaukee Public Museum, Contributions in Biology and Geology. No. 74:1-264. [Major source for West Indian reptiles]
- Society for the Study of Amphibians and Reptiles. 1971 et seq. *Catalogue of American Amphibians and Reptiles*. (Published by the American Society of Ichthyologists and Herpetologists, 1963-1970.)
- Stebbins, R. C. 2003. *A field guide to western reptiles and amphibians*. Third edition. Houghton Mifflin Company, Boston.

Class Amphibia (Amphibians)

- Collins, J. T., S. L. Collins, and T. W. Taggart. 2010. *Amphibians, reptiles, and turtles in Kansas*. Eagle Mountain Publishing, Eagle Mountain, Utah. xvi + 312 pp.
- Crother, B. I. (editor). 2008. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Sixth edition. Society for the Study of Amphibians and Reptiles Herpetological Circular 37:1-84.
- Frost, D. R. 2010. *Amphibian Species of the World: an Online Reference*. Version 5.4 (8 April 2010). Electronic Database accessible at <http://research.amnh.org/herpetology/amphibia/index.php>.
- American Museum of Natural History, New York, USA. Petraska, J. W. 1998. *Salamanders of the United States and Canada*. Smithsonian Institution Press, Washington, D.C.
- Society for the Study of Amphibians and Reptiles. 1971 et seq. *Catalogue of American Amphibians and Reptiles*. (Published by the American Society of Ichthyologists and Herpetologists, 1963-1970.)

Species at Risk on DoD Installations

- Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin Company, Boston.

Classes Myxini, Cephalaspidomorpha, Elasmobranchii, Holocephali, Actinopterygii, and Sarcopterygii (Fishes)

- Eschmeyer, W. N., editor. Catalog of fishes. California Academy of Sciences, San Francisco. Online. Available: <http://research.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>.
- Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh. [Used for North American fish subspecies names, within the framework of the species classification of the major source above.]
- Lee, D. S., S. P. Platania, and G. H. Burgess. 1983. Atlas of North American freshwater fishes. 1983 supplement. North Carolina State Museum of Natural History, Raleigh.
- Nelson, J. S., E. J. Crossman, H. Espinosa-Pérez, L. T. Findley, C. R. Gilbert, R. N. Lea, and J. D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. Sixth edition. American Fisheries Society Special Publication 29.
- Page, L. M., and B. M. Burr. 1991. A field guide to freshwater fishes: North America north of Mexico. Houghton Mifflin, New York.
- Nelson, J. S. 2006. Fishes of the world. Fourth edition. John Wiley and Sons, Inc., Hoboken, New Jersey. xix + 601 pp. [Used for higher taxonomy]

III. Freshwater Invertebrates

General

- Merritt, R. W. and K. W. Cummins. 1996. An Introduction to the Aquatic Insects of North America. Third Edition. Kendall/ Hunt Publishing Company: Dubuque, Iowa. 862 pp.
- Smith, D. G. 2001. Pennak's freshwater invertebrates of the United States. Fourth edition. John Wiley and Sons, Inc., New York. 638 pp.
- Thorp, J. H. and A. P. Covich (eds.). 2001. Ecology and classification of North American freshwater invertebrates. Second edition. Academic Press, California. 1056 pp.

Phylum Mollusca

- Cowie, R. H. 1998. Catalog and bibliography of the nonindigenous nonmarine snails and slugs of the Hawaiian Islands. Bishop Museum Occasional Papers 50: 1-66.

Species at Risk on DoD Installations

- Cowie, R. H., N. L. Evenhuis, and C. C. Christensen. 1995. Catalog of the native land and freshwater molluscs of the Hawaiian Islands. Backhuys Publications, Leiden, Netherlands. 248 pp.
- Hawaii Biological Survey Web Site. Available: <http://hbs.bishopmuseum.org/>.
- Turgeon, D. D., J. F. Quinn, A. E. Bogan, E. V. Coan, F. G. Hochberg, W. G. Lyons, P. M. Mikkelsen, R. J. Neves, C. F. E. Roper, G. Rosenberg, B. Roth, A. Scheltema, F. G. Thompson, M. Vecchione, and J. D. Williams. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: mollusks. Second edition. American Fisheries Society Special Publication 26: 1-509.

Phylum Cnidaria

- Cairns, S. D., D. R. Calder, A. Brinckmann-Voss, C. B. Castro, D. G. Fautin, P. R. Pugh, C. E. Mills, W. C. Jaap, M. N. Arai, S. H. D. Haddock, and D. M. Opresko. 2002. Common and scientific names of aquatic invertebrates from the United States and Canada: Cnidaria and Ctenophora. Second edition. American Fisheries Society Special Publication, 28: 1-115.

Phylum Ctenophora

- Cairns, S. D., D. R. Calder, A. Brinckmann-Voss, C. B. Castro, D. G. Fautin, P. R. Pugh, C. E. Mills, W. C. Jaap, M. N. Arai, S. H. D. Haddock, and D. M. Opresko. 2002. Common and scientific names of aquatic invertebrates from the United States and Canada: Cnidaria and Ctenophora. Second edition. American Fisheries Society Special Publication, 28: 1-115.

Phylum Crustacea

Freshwater crustaceans other than those groups listed below:

- Fitzpatrick, J. F. Jr. 1983. How to know the freshwater Crustacea. Wm. C. Brown Company Publishers, Iowa. [Used as a source for names of non-decapod crustaceans]
- McLaughlin, P.A., D.K. Camp, M.V. Angel, E.L. Bousfield, P. Brunel, R.C. Brusca, D. Cadien, A.C. Cohen, K. Conlan, L.G. Eldredge, D.L. Felder, J.W. Goy, T. Haney, B. Hann, R.W. Heard, E.A. Hendrycks, H.H. Hobbs III, J.R. Holsinger, B. Kensley, D.R. Laubitz, S.E. LeCroy, R. Lemaitre, R.F. Maddocks, J.W. Martin, P. Mikkelsen, E. Nelson, W.A. Newman, R.M. Overstreet, W.J. Poly, W.W. Price, J.W. Reid, A. Robertson, D.C. Rogers, A. Ross, M. Schotte, F. Schram, C. Shih, L. Watling, G.D.F. Wilson, and D.D. Turgeon. 2005. Common and scientific names of aquatic invertebrates from the United States and Canada: Crustaceans. American Fisheries Society Special Publication 31: 545 pp.

Class Malacostraca, Order Decapoda (Crayfishes and other decapods)

- Belk, D. 1975. Key to the Anostraca (fairy shrimps) of North America. *The Southwestern Naturalist* 20(1); 91-103.
- Crayfish Home Page: Brigham Young University. Available: <http://crayfish.byu.edu>.
- Hobbs, H. H., Jr. 1989. An illustrated checklist of the American crayfishes (Decapoda: Astacidae, Cambaridae & Parastacidae). *Smithsonian Contributions to Zoology* 480: 1-236.
- McLaughlin, P.A., D.K. Camp, M.V. Angel, E.L. Bousfield, P. Brunel, R.C. Brusca, D. Cadien, A.C. Cohen, K. Conlan, L.G. Eldredge, D.L. Felder, J.W. Goy, T. Haney, B. Hann, R.W. Heard, E.A. Hendrycks, H.H. Hobbs III, J.R. Holsinger, B. Kensley, D.R. Laubitz, S.E. LeCroy, R. Lemaitre, R.F. Maddocks, J.W. Martin, P. Mikkelsen, E. Nelson, W.A. Newman, R.M. Overstreet, W.J. Poly, W.W. Price, J.W. Reid, A. Robertson, D.C. Rogers, A. Ross, M. Schotte, F. Schram, C. Shih, L. Watling, G.D.F. Wilson, and D.D. Turgeon. 2005. Common and scientific names of aquatic invertebrates from the United States and Canada: Crustaceans. *American Fisheries Society Special Publication* 31: 545 pp.

Class Branchiopoda (e.g., Fairy, Clam, and Tadpole Shrimps)

- Braband, A., S. Richter, R. Hiesel, and G. Scholtz. 2002. Phylogenetic relationships within the Phyllopoda (Crustacea, Branchiopoda) based on mitochondrial and nuclear markers. *Molecular Phylogenetics and Evolution*, 25: 229-244.
- Hoeh, W.R., N.D. Smallwood, D.M. Senyo, E.G. Chapman, and S.C. Weeks. 2006. Evaluating the monophyly of Eulimnadia and the Limnadiinae (Branchiopoda: Spinicaudata) using DNA sequences. *Journal of Crustacean Biology*, 26(2): 182-192.
- Jass, J. and B. Klausmeier. 2000. Atlas and bibliography of the first state and county records for anostracans (Crustacea: Branchiopoda) of the contiguous United States. *Contributions in Biology and Geology, Milwaukee Public Museum* 94: 1-158.
- McLaughlin, P.A., D.K. Camp, M.V. Angel, E.L. Bousfield, P. Brunel, R.C. Brusca, D. Cadien, A.C. Cohen, K. Conlan, L.G. Eldredge, D.L. Felder, J.W. Goy, T. Haney, B. Hann, R.W. Heard, E.A. Hendrycks, H.H. Hobbs III, J.R. Holsinger, B. Kensley, D.R. Laubitz, S.E. LeCroy, R. Lemaitre, R.F. Maddocks, J.W. Martin, P. Mikkelsen, E. Nelson, W.A. Newman, R.M. Overstreet, W.J. Poly, W.W. Price, J.W. Reid, A. Robertson, D.C. Rogers, A. Ross, M. Schotte, F. Schram, C. Shih, L. Watling, G.D.F. Wilson, and D.D. Turgeon. 2005. Common and scientific names of aquatic invertebrates from the United States and Canada: Crustaceans. *American Fisheries Society Special Publication* 31: 545 pp.
- Murugan, G., A.M. Maeda-Martinez, H. Obregon-Barboza, and N.Y. Hernandez-Saavedra, 2002. Molecular characterization of the tadpole shrimp Triops (Branchiopoda: Notostraca) from the Baja California Peninsula, Mexico: New

insights on species diversity and phylogeny of the genus. *Studies on Large Branchiopod Biology, Hydrobiologia*, 486: 101-113.

- Rogers, D.C. 2002. A morphological re-evaluation of the anostracan families Linderiellidae and Polyartemiidae, with a redescription of the linderiellid *Dexteria floridana* (Dexter 1956) (Crustacea: Branchiopoda). *Hydrobiologia*, 486: 57-61.
- Rogers, D.C. 2003. Revision of the thamnocephalid genus *Phallocryptus* (Crustacea; Branchiopoda; Anostraca). *Zootaxa* 257: 1-14.
- Rogers, D.C. 2006. A genus level revision of the Thamnocephalidae (Crustacea: Branchiopoda: Anostraca). *Zootaxa*, 1260: 1-25.

IV. Phylum Chelicerata

Order Araneae (Spiders)

- Platnick, N. I. 2010b. The world spider catalog, version 11. American Museum of Natural History. Online. Available: <http://research.amnh.org/iz/spiders/catalog/>.
- Paquin, P., D. J. Buckle, N. Duperre, and C. D. Dondale. 2010. Checklist of the spiders (Araneae) of Canada and Alaska. *Zootaxa* 2461:1-170.

V. Phylum Mandibulata (insects, centipedes, millipedes)

Groups not covered by other sources listed below:

- Arnett, R. H. 2000. *American insects: A handbook of the insects of America north of Mexico*. Second edition. CRC Press, New York.
- Nishida, G. M. editor. 2002. *Hawaiian terrestrial arthropod checklist*. Fourth edition. Bishop Museum Technical Report 22: iv + 310 p. Available online: <http://www2.bishopmuseum.org/HBS/checklist/query.asp?grp=Arthropod>.
- Poole, R. W., and P. Gentili (eds.). 1996-1997. *Nomina Insecta Nearctica*. A checklist of the insects of North America. Entomological Information Services, Rockville, MD. Four volumes. Available online: <http://www.nearctica.com/nomina/main.htm>.

Order Coleoptera

General

- Arnett, R.H., Jr., and M.C. Thomas. 2000. *American beetles. Volume 1: Archostemata, Myxophaga, Adephaga, Polyphaga: Staphyliniformia*. CRC Press LLC, Boca Raton, Florida. 443 pp. [Used for higher taxonomy through family and subfamily, excluding Cicindelidae]
- Arnett, R.H., Jr., M.C. Thomas, P.E. Skelley, and J.H. Frank. 2002. *American beetles. Volume 2: Polyphaga: Scarabaeoidea through Curculionoidea*. CRC Press

LLC, Boca Raton, Florida. 861 pp. [Used for higher taxonomy through family and subfamily, excluding Cicindelidae]

Family Cicindelidae (Tiger Beetles)

- Freitag, R. 1999. Catalogue of the tiger beetles of Canada and the United States. NRC Research Press, Ottawa, Ontario, Canada K1A 0R6.
- Pearson, D. L. 2004. A list of suggested common English names for species of tiger beetles occurring in Canada and the U.S. *Cicindela* 36(1-2):31-40. [Used for North American common names]
- Pearson, D. L., C. B. Knisley and C. J. Kazilek. 2006. A field guide to the tiger beetles of the United States and Canada: identification, natural history, and distribution of the Cicindelidae. Oxford University Press, New York, New York. 227 pp.

VI. Order Ephemeroptera (Mayflies)

- Purdue University Department of Entomology (W.P. McCafferty ed.) 1995. Last updated 8 March 2010. Mayfly Central- The Mayflies of North America. Online. Available: <http://www.entm.purdue.edu/mayfly/>.

VII. Order Hymenoptera, Family Formicidae (Ants)

- Bolton, B., G. Alpert, P. S. Ward, and P. Naskrecki. 2006. Bolton's catalogue of ants of the world 1785-2005. President and Fellows of Harvard College, Harvard University Press, Cambridge MA. CD-ROM.
- Fisher, B. L. and S. P. Cover. 2007. Ants of North America. A guide to the genera. University of California Press. 308 pp.

VIII. Order Hymenoptera, Superfamily Apoidea (Bees and Sphecoid Wasps), Apiformes (Bees)

- Integrated Taxonomic Information System (ITIS). 2009. World Bee Checklist Project (version 09-Dec-2009). Integrated Taxonomic Information System: Biological Names. Online. Available: <http://www.itis.gov/beechecklist.html>.
- Michener, C. D. 2000. The bees of the World. Johns Hopkins University Press, Baltimore, MD. [Used for higher taxonomy through genus and subgenus, excluding species in genus *Bombus*.]
- Williams, P. H. 2008. *Bombus*, bumblebees of the world. Web pages based on Williams, P.H. 1998. An annotated checklist of bumblebees with an analysis of patterns of description (Hymenoptera: Apidae, Bombini). *Bulletin of the Natural History Museum (Entomology)* 67:79-152. Online. Available: <http://www.nhm.ac.uk/research-curation/research/projects/bombus/index.html>.

IX. Order Diplura

- Allen, R. T. 2002. A synopsis of the Diplura of North America: keys to higher taxa, systematics, distributions and descriptions of new taxa (Arthropoda: Insecta). *Transactions of the American Entomological Society* 128(4):403-466.

X. Order Lepidoptera (Default for taxa not covered by more current revisions, also followed for many Geometridae):

- Hodges, R. W., T. Dominick, D. R. Davis, D. C. Ferguson, J. C. Franclemont, E. C. Munroe, and J. A. Powell, Eds. 1983. Check list of the Lepidoptera of America North of Mexico. E. W. Classey Lmtd. and The Wedge Entomological Research Foundation, Washington, D.C.
- Wagner 2005: Wagner, D. L. 2005. *Caterpillars of Eastern North America: A Guide to Identification and Natural History*. Princeton University Press. 512 pp.
- Schweitzer, D. F., M. C. Minno, and D. L. Wagner. 2011. *Rare, Declining, and Poorly Known Butterflies and Moths (Lepidoptera) of Forests and Woodlands in the Eastern United States*. USFS Technology Transfer Bulletin, FHTET-2011-01. ca. 500 pp. (especially useful for circumscriptions of unnamed species)

Order Lepidoptera, Superfamilies Papilionoidea (True Butterflies) and Hesperioidea (Skippers)

- Cassie, B., J. Glassberg, A. Swengel and G. Tudor. 2001. North American Butterfly Association (NABA) checklist and English names of North American butterflies. North American Butterfly Association, Morristown, NJ. 41 pp. Online. Available: <http://www.naba.org/pubs/checklst.html>. [Used only for English common names.]
- Emmel, T. C., ed. 1998. *Systematics of western butterflies*. Mariposa Press, Gainesville, Florida. [Source for many subspecies names and circumscriptions.]
- Layberry, R. A., P. W. Hall, and J. D. Lafontaine. 1998. *The butterflies of Canada*. University of Toronto Press, Toronto.
- Opler, P. A., and A. D. Warren. 2004. *Butterflies of North America. 2. Scientific Names List for Butterfly Species of North America, north of Mexico*. C.P Gillette Museum of Arthropod Diversity, Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, Colorado. 79 pp. [Source for almost all NatureServe species concepts for North American butterflies and skippers]
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- Ferguson, D.C. 2008. Moths of America North of Mexico. Fascicle 17.2. Geometroidea, Geometridae, Ennominae (part: Abaxini, Cassymini, Macariini). *The Wedge Entomological Research Foundation*. 430 pp.
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Order Lepidoptera, Families Saturniidae (Giant Silk Moths) and Sphingidae (Sphinx Moths)

- Opler, P. A. 1995. *Lepidoptera of North America: 1. Distribution of silkmoths (Saturniidae) and hawkmoths (Sphingidae) of eastern North America*. Contributions of the C. P. Gillette Insect Biodiversity Museum, Department of Entomology, Colorado State University, Fort Collins.
- Peigler, R. S., and P. A. Opler. 1993. *Moths of western North America: 1. Distribution of Saturniidae of western North America*. Contributions of the C. P. Gillette Insect Biodiversity Museum, Department of Entomology, Colorado State University, Fort Collins.
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- Ferguson, D.C. 1978. *The Moths of America North of Mexico*. Fascicle 22.2: Noctuoidea, Lymantriidae. Curwen Press, London

Order Lepidoptera, Family Erebidae, Subfamily Arctiinae (Tiger Moths)

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- Ferguson, D. C., P. A. Opler, M. J. Smith, and J. P. Donahue. 2000. Moths of Western North America 3: Distribution of Arctiidae of Western North America. Part 1. Text, maps, and references. Contributions of the C. P. Gillette Arthropod Biodiversity Museum, Colorado State University, Fort Collins, Colorado. 170 pp.
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Order Lepidoptera, Family Erebidae, Genus *Catocala* (Underwing Moths)

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Order Lepidoptera, Family Noctuidae, Genus *Papaipema* (Papaipema Moths) and related mostly undescribed genera (mainly cane borers)

- Eric L. Quinter, P.O. Box 74, Willimantic, CT 06266-0074
- Quinter, E. L. in Hodges, R. W., T. Dominick, D. R. Davis, D. C. Ferguson. J. C. Franclemont, E. C. Munroe, and J. A. Powell, Eds. 1983. Check list of the Lepidoptera of America North of Mexico. E. W. Classey Lmted. and The Wedge Entomological Research Foundation, Washington, D.C.

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- Lafontaine, J.D. 2004. Moths of America North of Mexico, Fascicle 27.1 Noctuoidea, Noctuidae (Noctuinae part: Agrotini). 385 pp., 75 plates.
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- Lafontaine, J. D, and B. C. Schmidt. 2010. Annotated check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico. ZooKeys 40:1-239.(used for almost all classification above and most at or below genus level).
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- Wagner, D. L., D. F. Schweitzer, J. B. Sullivan, and R. C. Reardon. 2011. Owllet Caterpillars of Eastern North America (Lepidoptera: Noctuidae). Princeton University Press. 576 pp.

XI. Order Odonata (Dragonflies and Damselflies)

- Abbott, J.C. 2007. Last updated 2011. OdonataCentral. The University of Texas at Austin, School of Biological Sciences, Section of Integrative Biology. Available at: <http://www.odonatacentral.org/>.
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- Order Orthoptera (Grasshoppers, Katydid, Crickets)
- Capinera, J. L., R. D. Scott, and T. J. Walker. 2004. Field guide to grasshoppers, katydids and crickets of the United States. Comstock Publishing Associates, Cornell University Press, Ithaca, NY. 249 pp.
- Eades, D.C., D. Otte. 2006. Orthoptera Species File Online. Version 2.0/3.4. Online. Available: <http://osf2.orthoptera.org/HomePage.aspx>.
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- Otte, Daniel. Department of Entomology, The Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

XII. Order Plecoptera (Stoneflies)

- Stark, B.P., R.W. Baumann, and R.E. DeWalt. 1996. Valid stonefly names for North America. Last updated 19 March 2009. Online. Available: <http://plsa.inhs.uiuc.edu/plecoptera/validnames.aspx>.
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- Stewart, K.W. and M.W. Oswood. 2006. The Stoneflies (Plecoptera) of Alaska and Western Canada. The Caddis Press: Columbus, Ohio. 325 pp.

XIII. Order Trichoptera (Caddisflies)

- Morse, J.C. 1993. A checklist of the Trichoptera of North America, including Greenland and Mexico. Transactions of the American Entomological Society 119(1): 47-93. [Updates available from Trichoptera World Checklist at: <http://entweb.clemson.edu/database/trichopt/>]

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Appendix 5.1h. Supplemental State-Specific Documentation

This supplement provides state-specific documentation as part of the species at risk on DoD Installations project.

State Protection Status (SPROT)

The State Protection Status (SPROT) field is an abbreviation used by state for the level of legal protection afforded to the element by that entity. Abbreviations and definitions will vary by state or subnation. Those SPROT values used in this data set are shown in the table below. States that are not included in this table did not have any SAR with SPROT values.

Program	Subnational Protection Status	Definition	Legal Status
AK	Species of Special Concern	Species of Special Concern is any species or subspecies of fish or wildlife or population of mammal or bird native to Alaska that has entered a long-term decline in abundance or is vulnerable to a significant decline due to low numbers, restricted distribution, dependence on limited habitat resources, or sensitivity to environmental disturbance.	Unknown
AL	SP	State Protected: Species with a state protected status are protected by Regulation 220-2-.92 (Nongame Species Regulation), 220-2-.98 (Invertebrate Species Regulation), 220-2-.26(4) (Protection of Sturgeon), 220-2-.94 (Prohibition of Taking or Possessing Paddlefish), or 220-2-.97 (Alligator Protection Regulation) of the Alabama Regulations on Game, Fish, and Fur Bearing Animals. Copies of these regulations may be obtained from the Division of Wildlife & Freshwater Fisheries, Alabama Department of Conservation & Natural Resources, 64 North Union Street, Montgomery, AL 36104. A digital version of these regulations is available online at http://www.outdooralabama.com/hunting/regulations/ . The Nongame Species Regulation (Section 220-2-.92) is also available online at: http://www.outdooralabama.com/watchable-wildlife/regulations/nongame.cfm .	Yes
AZ	HS	Highly safeguarded: no collection allowed (plants)	Yes
AZ	SR	Salvage restricted: collection only with permit (plants)	Yes
AZ	WSC	Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and Fish Department's listing of Wildlife of Special Concern in Arizona (WSCA, in prep). Species indicated on printouts as WC are currently the same as those in Threatened Native Wildlife in Arizona (1988).	No
CA	Endangered	A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease	Yes

Species at Risk on DoD Installations

Program	Subnational Protection Status	Definition	Legal Status
CA	Rare	A native plant is rare when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens	Yes
CA	Threatened	A native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter	Yes
CO	SC	Special Concern (animals)	No
CO	ST	State threatened; elements that are not in immediate jeopardy of extinction, but are vulnerable due to small numbers, restricted throughout its range, or experiencing low recruitment or survival.	Yes
FL	LE	PLANTS: Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.	Yes
FL	LT	PLANTS: Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.	Yes
FL	SSC	ANIMALS: Listed as Species of Special Concern by the Florida Fish and Wildlife Conservation Commission. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species.	Yes
FL	ST	ANIMALS: State population listed as Threatened by the Florida Fish and Wildlife Conservation Commission. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.	Yes
FL	ST	ANIMALS: State population listed as Threatened by the Florida Fish and Wildlife Conservation Commission. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.	Yes
GA	E	Listed as endangered. A species that is in danger of extinction throughout all or part of its range.	Yes
GA	R	Listed as rare. A species that may not be endangered or threatened but which should be protected because of its scarcity.	Yes
GA	R	Listed as rare. A species that may not be endangered or threatened but which should be protected because of its scarcity.	Yes
GA	T	Listed as threatened. A species that is likely to become an endangered species in the foreseeable future throughout all or parts of its range.	Yes

Species at Risk on DoD Installations

Program	Subnational Protection Status	Definition	Legal Status
GA	T	Listed as threatened. A species that is likely to become an endangered species in the foreseeable future throughout all or parts of its range.	Yes
IA	T	Threatened - any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. (Iowa Administrative Code definition)	Yes
ID	G	Game - Those species of wildlife classified as Big Game Animals, Upland Game Animals, Game Birds, Migratory Birds, Game Fish, Crustacea, or Furbearing Animals may be taken only in accordance with Idaho law and rules established by the Idaho Fish and Game Commission. (4-6-05)	Yes
IL	LT	Listed Threatened (plants and animals)	Yes
IL	RT	Removed from Threatened species list (plants and animals)	No
IN	SE	State Endangered (legal protection for mammals, fish, birds, reptiles, amphibians, mussels): Any animal species whose prospects for survival or recruitment within the state are in immediate jeopardy and are in danger of disappearing from the state. This includes all species classified as endangered by the federal government which occur in Indiana. Plants and insects known to occur currently on five or fewer sites in the state.	No
IN	SE	State Endangered (legal protection for mammals, fish, birds, reptiles, amphibians, mussels): Any animal species whose prospects for survival or recruitment within the state are in immediate jeopardy and are in danger of disappearing from the state. This includes all species classified as endangered by the federal government which occur in Indiana. Plants and insects known to occur currently on five or fewer sites in the state.	Yes
IN	SSC	Species of Special Concern - Any animal species about which some problems of limited abundance or distribution in Indiana are known or suspected and should be closely monitored.	Yes
KS	C	Species in need of conservation (animals)	No
KY	E	Endangered. A taxon in danger of extirpation and/or extinction throughout all or a significant part of its range in Kentucky.	Unknown
KY	S	Special Concern. A taxon that should be monitored because (1) it exists in a limited geographic area in Kentucky, (2) it may become threatened or endangered due to modification or destruction of habitat, (3) certain characteristics or requirements make it especially vulnerable to specific pressures, (4) experienced researchers have identified other factors that may jeopardize it, or (5) it is thought to be rare or declining in Kentucky but insufficient information exists for assignment to the threatened or endangered status categories.	Unknown
KY	T	Threatened. A taxon likely to become endangered within the foreseeable future throughout all or a significant part of its range in Kentucky.	Unknown
MA	E	Endangered (legal protection)	Yes
MA	T	Threatened (legal protection)	Yes
MD	E	Endangered (plants and animals)	Yes
MD	T	Threatened (plants and animals)	Yes

Species at Risk on DoD Installations

Program	Subnational Protection Status	Definition	Legal Status
ME	SC	SPECIAL CONCERN. PLANTS: Rare in Maine, based on available information, but not sufficiently rare to be considered Threatened or Endangered. ANIMALS: Believed to be vulnerable and could easily become threatened or endangered because of restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors. They include species suspected of being threatened or endangered or likely to become so, but for which insufficient data are available.	No
MI	E	Endangered (legally protected)	Yes
MI	SC	Special Concern (Rare or status uncertain; not legally protected)	Unknown
MI	SC	Special Concern (Rare or status uncertain; not legally protected)	No
MI	T	Threatened (legally protected)	Yes
MN	NON	Watchlist: A species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories: the species is being considered for addition to the state list; the species was removed from the state list but records for the species are still entered and maintained as a precautionary measure; the species has been recently discovered in the state; the species is presumed to be extirpated from the state.	No
MN	SPC	Special Concern species: A plant or animal species that is extremely uncommon in Minnesota, or has a unique or highly specific habitat requirements, and deserves careful monitoring. Species on the periphery of their ranges may be included in this category, as well as species that were once threatened or endangered but now have increasing, or stable and protected, populations.	No
MS	LE	State protected listed endangered (animals)	Yes
MT	SOC	Species of Concern are native taxa that are at-risk due to declining population trends, threats to their habitats, restricted distribution, and/or other factors. Designation as a Montana Species of Concern is based on the Montana Status Rank and is not a statutory or regulatory classification. Rather, these designations provide information that helps resource managers make proactive decisions regarding species conservation and data collection priorities.	No
NC	E	Endangered	Yes
NC	SC	Special Concern	Yes
NC	SC-V	Special Concern-Vulnerable	Yes
NC	SR	Significantly Rare [Animals only.]	No
NC	SR-L	Significantly Rare - Limited (The range of the species is limited to North Carolina and adjacent states (endemic or near endemic). These are species which may have 20-50 populations in North Carolina, but fewer than 50 populations rangewide. The preponderance of their distribution is in North Carolina and their fate depends largely on conservation here. Also included are some species with 20-100 populations in North Carolina, if they also have only 50-100 populations rangewide and declining.) [Plants only.]	No
NC	SR-T	Significantly Rare - Throughout (These species are rare throughout their ranges (fewer than 100 populations total)). [Plants only.]	No
NC	T	Threatened	Yes

Species at Risk on DoD Installations

Program	Subnational Protection Status	Definition	Legal Status
NJ	E	Endangered	Yes
NJ	S/S	stable/stable (breeding / nonbreeding statuses)	No
NJ	SC/SC	special concern/special concern (breeding / nonbreeding statuses)	Yes
NJ	T/T	threatened/threatened (breeding / nonbreeding statuses)	Yes
NM	E	Endangered - As used in the Wildlife Conservation Act [17-2-37 to 17-2-46 NMSA (New Mexico Statutes Annotated) 1978]: "ENDANGERED SPECIES" "formerly called 'Group 1'" means any species of fish or wildlife whose prospects of survival or recruitment within the state are in jeopardy due to any of the following factors: 1) the present or threatened destruction, modification or curtailment of its habitat; 2) overutilization for scientific, commercial or sporting purposes; 3) the effect of disease or predation; 4) other natural or man-made factors affecting its prospects of survival or recruitment within the state; or 5) any combination of the foregoing factors.	Yes
NM	T	Threatened - As defined in the Wildlife Conservation Act [17-2-37 to 17-2-46 NMSA (New Mexico Statutes Annotated) 1978]: "THREATENED SPECIES" "formerly called 'Group 2'" means any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range in New Mexico; the term may also include any species of fish and wildlife appearing on the United States list of endangered native and foreign fish and wildlife as set forth in Section 4 of the Endangered Species Act of 1973 as threatened species, provided that the commission adopts the list in whole or in part.	Yes
NV	YES	Species protected under N.R.S. 501 and listed under N.A.C. 503.020. (animals)	Yes
NY	E	Endangered (plants and animals): Listed as Endangered by New York State: in imminent danger of extirpation in New York. For animals, taking, importation, transportation, or possession is prohibited, except under license or permit. For plants, removal or damage without the consent of the landowner is prohibited. (legal protection)	Yes
NY	SC	Special Concern (animals): Listed as Special Concern by New York State: at risk of becoming Threatened; not listed as Endangered or Threatened, but concern exists for its continued welfare in New York; NYS DEC may promulgate regulations as to the taking, importation, transportation, or possession as it deems necessary. (legal protection)	Yes
NY	T	Threatened (plants and animals): Listed as Threatened by New York State: likely to become Endangered in the foreseeable future. For animals, taking, importation, transportation, or possession is prohibited, except under license or permit. For plants, removal or damage without the consent of the landowner is prohibited. (legal protection)	Yes
OH	E	Endangered (plants and animals)	Yes
OR	LE	Listed Endangered. Taxa listed by the USFWS or the National Marine Fisheries Service (NOAA Fisheries) as Endangered under the Endangered Species Act (ESA), or by the Oregon Dept. of Agriculture (ODA) or Oregon Dept. of Fish and Wildlife (ODFW) under the Oregon Endangered Species Act of 1987 (OESA).	Yes

Species at Risk on DoD Installations

Program	Subnational Protection Status	Definition	Legal Status
TN	D	Deemed in need of management (nongame animals) - Any species or subspecies of nongame wildlife which the executive director of the TWRA believes should be investigated in order to develop information relating to populations, distribution, habitat needs, limiting factors, and other biological and ecological data to determine management measures necessary for their continued ability to sustain themselves successfully. This category is analogous to "Special Concern."	Yes
TN	E	Endangered (plants and animals) - Any species or subspecies whose prospects of survival or recruitment within the state are in jeopardy or are likely to become so within the foreseeable future	Yes
TX	T	Threatened species are those species which the TPW Commission has determined are likely to become endangered in the future. (http://www.tpwd.state.tx.us/nature/endang/regulations/texas/)	Yes
UT	None	No state protection status. Species is not included on the Utah Sensitive Species List.	No
UT	S-ESA	Federally-listed or candidate species under the Endangered Species Act.	Yes
UT	S-ESA, CS	Federally-listed or candidate species under the Endangered Species Act; Species receiving special management under a Conservation Agreement in order to preclude the need for Federal listing.	Yes
VA	LE	listed endangered (protected)	Yes
VA	LT	listed threatened (protected)	Yes
VT	E	Endangered, in immediate danger of becoming extirpated in the state. 10 Vermont State Annotated (V.S.A.) Chapter 123 Protection of Endangered Species	Yes
VT	T	Threatened, with high possibility of becoming endangered in the near future.	Yes
WA	E	Endangered. In danger of becoming extinct or extirpated from Washington. (animals and plants) No legal protection.	No
WA	S	Sensitive. Vulnerable or declining and could become Endangered or Threatened in the state. (animals and plants) No legal protection.	No
WA	T	Threatened. Likely to become Endangered in Washington. (animals and plants) No legal protection.	No
WI	END	State Endangered (plants and animals)	Yes
WI	THR	State Threatened (plants and animals)	Yes

State-Specific Documentation and Data Issues

NatureServe used species location data aggregated from its network of natural heritage member programs to determine the Species at Risk that intersected with the buffered DoD Installations. This Appendix contains state-specific documentation of data inventory completeness and known data gaps as provided by NatureServe member programs. If no gaps are listed for a state, that means there were no gaps in a state's documentation that was provided to NatureServe; however, it does not necessarily mean no data gaps exist. If there is any question as to the completeness of data in a particular area of a state, the member program can be contacted directly or through NatureServe for further information.

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix_5.1h_State_Data_Documentation_2014.xlsx**).

5.2 Species at Risk on DoD Installations: Summary Information

Summarized identification and status information of all species at risk occurring on DoD installations. Species are grouped into four categories: (a) federal proposed or candidates, (b) critically imperiled (G1/T1), (c) imperiled (G2/T2), and (d) vulnerable birds (G3/T3 or IUCN status of CR, EN, VU, or NT). Note: All federal candidate or proposed species are in category (a) for all analyses in report. Some of these species may also have a NatureServe Conservation Status of G1/T1, G2/T2, or G3/T3 or have an IUCN status.

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix 5.2_SAR on DoD installations_summary_2014.xls**).

5.3 DoD Installations with Species at Risk: Summary Information

Summary of DoD installations with species at risk, including the number of species at risk found on installations and installation size (square miles).

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix 5.3_DoD installations with SAR_summary_2014.xls**).

5.4 DoD Installations with Species at Risk: Comprehensive Information

List of DoD installations with species at risk, including comprehensive information about the species at risk that occur on them. For additional information about species biology and habitat requirements, see the link to detailed information on NatureServe Explorer included in Appendix 5.2.

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix 5.4_DoD installations with SAR_comprehensive_2014.xls**).

5.5 DoD Installations without Species at Risk

DoD Installations in the Data.gov layer without species at risk. Note: The absence of species at risk on any particular Installation does not necessarily mean that no at-risk species are present. Many areas in the United States have not been adequately inventoried and new locations of species are continuously being discovered.

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix 5.5_DoD installations_without_SAR_2014.xls**).

5.6 DoD Installations that were Merged or Excluded from Analysis

DoD installations from the data.gov layer that were merged or excluded from the analysis due to the appearance of duplicate names with other installations that were included.

Note: Data shown here are included in spreadsheet format submitted electronically (filename: **14-772_Appendix 5.6_merged-or-excluded-installations_2014.xls**).