Department of Defense
Legacy Resource Management Program

10-247

Species at Risk on Department of Defense Lands: Updated Analysis, Report, and Maps

NatureServe

July 2011

Species at Risk on Department of Defense Lands:

Updated Analysis, Report, and Maps

Report and Documentation

Prepared for:

Department of Defense

Legacy Program

Project 10-247

Submitted by:

NatureServe

July 2011

TABLE OF CONTENTS

1.0 Executive Summary iii
2.0 Introduction – Project Description 1
3.0 Methods 3
3.1 NatureServe Data 3
3.2 DoD Installations 7
3.3 Species at Risk 8
4.0 Results 9
4.1 Nationwide Assessment of Species at Risk on DoD Installations 9
4.2 Assessment of Species at Risk by Military Service 13
4.3 Assessment of Species at Risk on Installations 14
5.0 Appendices 17
5.1 Metadata 17
5.2 Species at Risk on DoD Installations: Summary Information 72
5.3 Species at Risk on DoD Installations: Comprehensive Information 73
5.4 DoD Installations with Species at Risk: Summary Information 74
5.5 DoD Installations with Species at Risk: Comprehensive Information 75
5.6 DoD Installations without Species at Risk 76
5.7 DoD Installations that were Merged or Excluded from Analysis 77

1.0 Executive Summary

Department of Defense 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 the Department of Defense 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 analysis represents an update of a previous analysis by NatureServe, also funded by the Department of Defense Legacy Program that was 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 <u>not</u> 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. NatureServe provides two major types of analyses in this report: (1) analyses of <u>species</u> at risk that are highly dependent on DoD lands and management for their survival, and (2) analyses of <u>installations</u> 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 2011 assessment is that the total number of species at risk on DoD lands remained similar to the numbers based on the 2002 data (519 species at risk were reported in 2011, compared to 523 species reported in the 2004 report), despite an increase of over 25,000 new species at risk element occurrences in NatureServe's databases since 2002. On closer inspection, although the total number changed very little, the actual species on the lists changed fairly significantly. The reasons for these changes in species lists are due to several factors, including new element 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.

2.0 Introduction – Project Description

Department of Defense 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 the Department of Defense 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 2004, NatureServe provided the USFWS and the Department of Defense 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 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 July 2009, there are 69,900 total element occurrences across the U.S. that meet the criteria of the project. This represents more than 25,583 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 the Department of Defense 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 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. 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 Department of Defense installation.

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) 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/explorer/ranking.htm

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/visitLocal/index.jsp).

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.
- 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" (6/30/2010) 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* (rounded global rank of G3) birds, according to the NatureServe conservation status rank criteria.

Accordingly, three 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)

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

Fig. 1: % of Species at Risk by Status

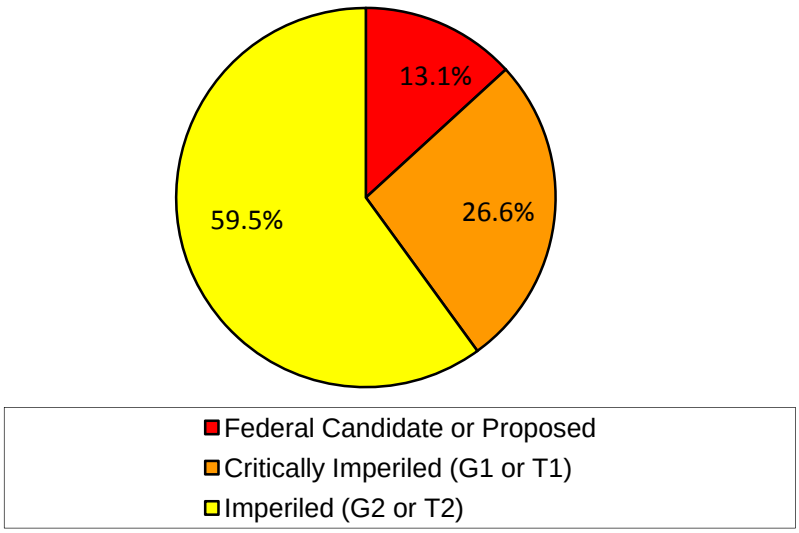
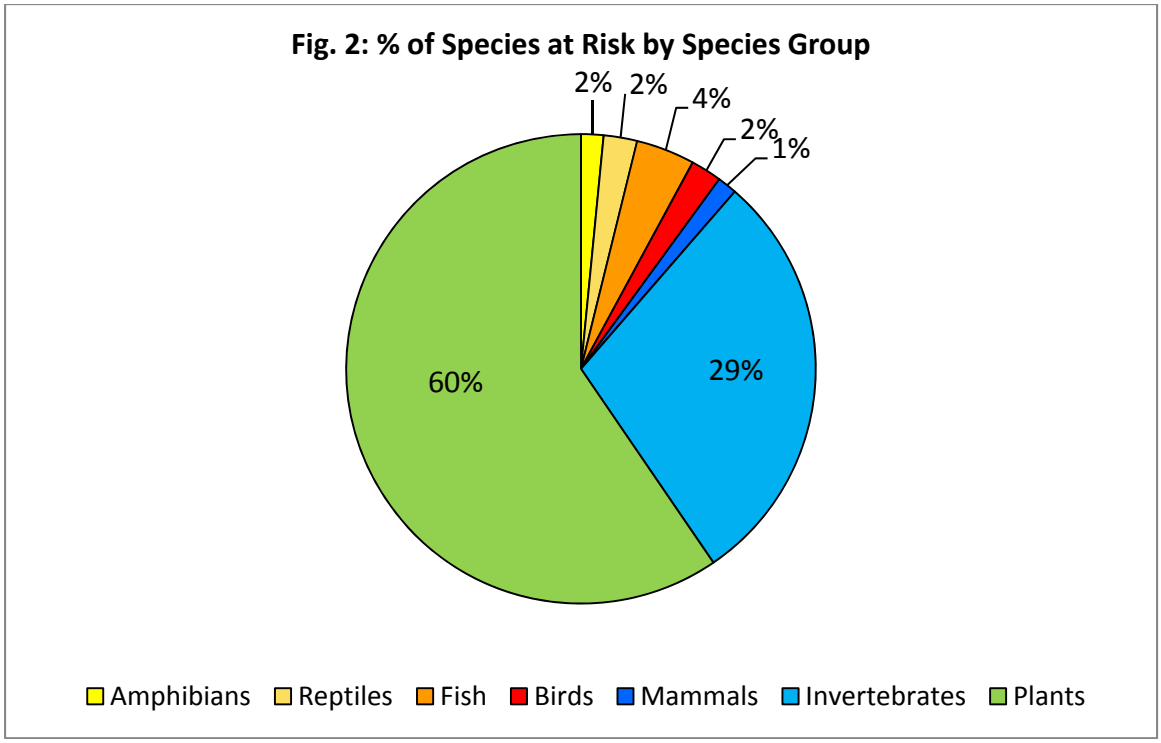


Fig. 2: % of Species at Risk by Species Group



4.1.2 Geography of Species at Risk

Fig. 3: Number of SAR on Individual Installations

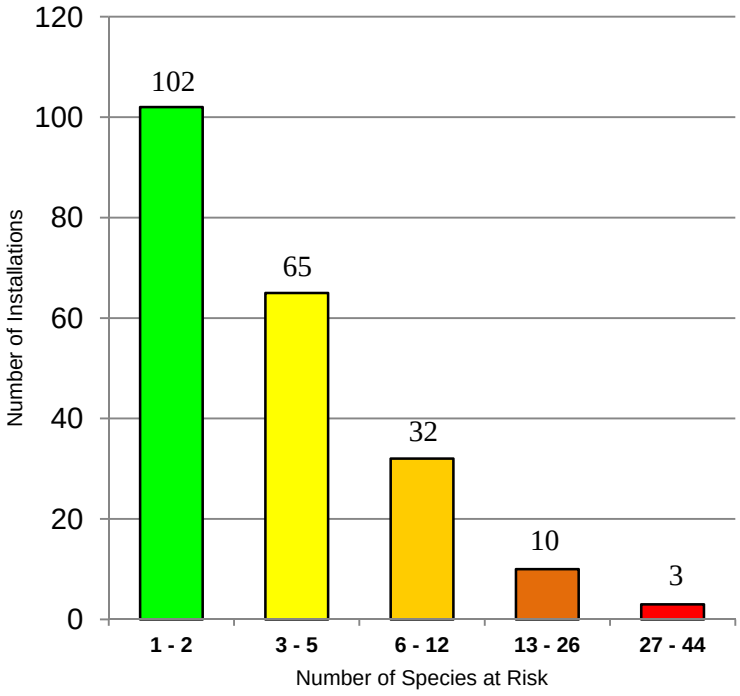


Figure 4a. Map depicting the number of species at risk found on DoD installations across the fifty U.S. states. The absence of data in any particular geographic area does not necessarily indicate that species at risk are not present. SOURCES: NatureServe 2011, Data.gov 2011.

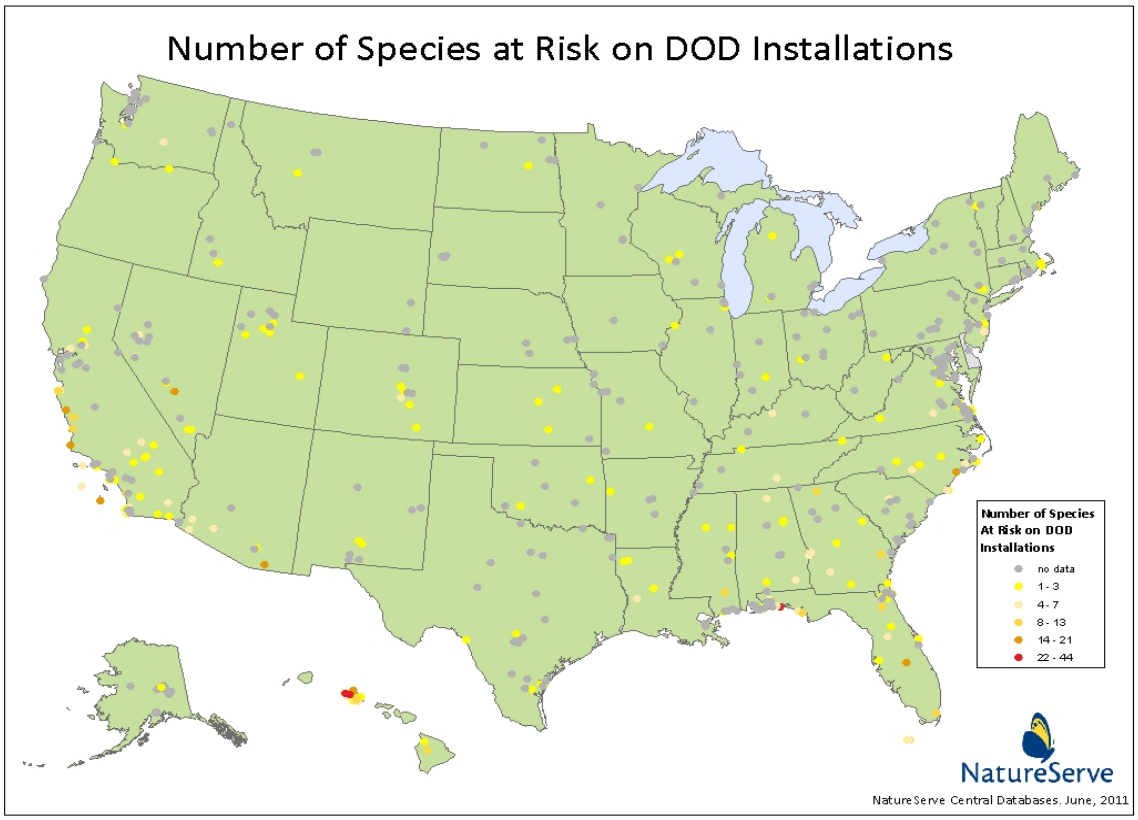
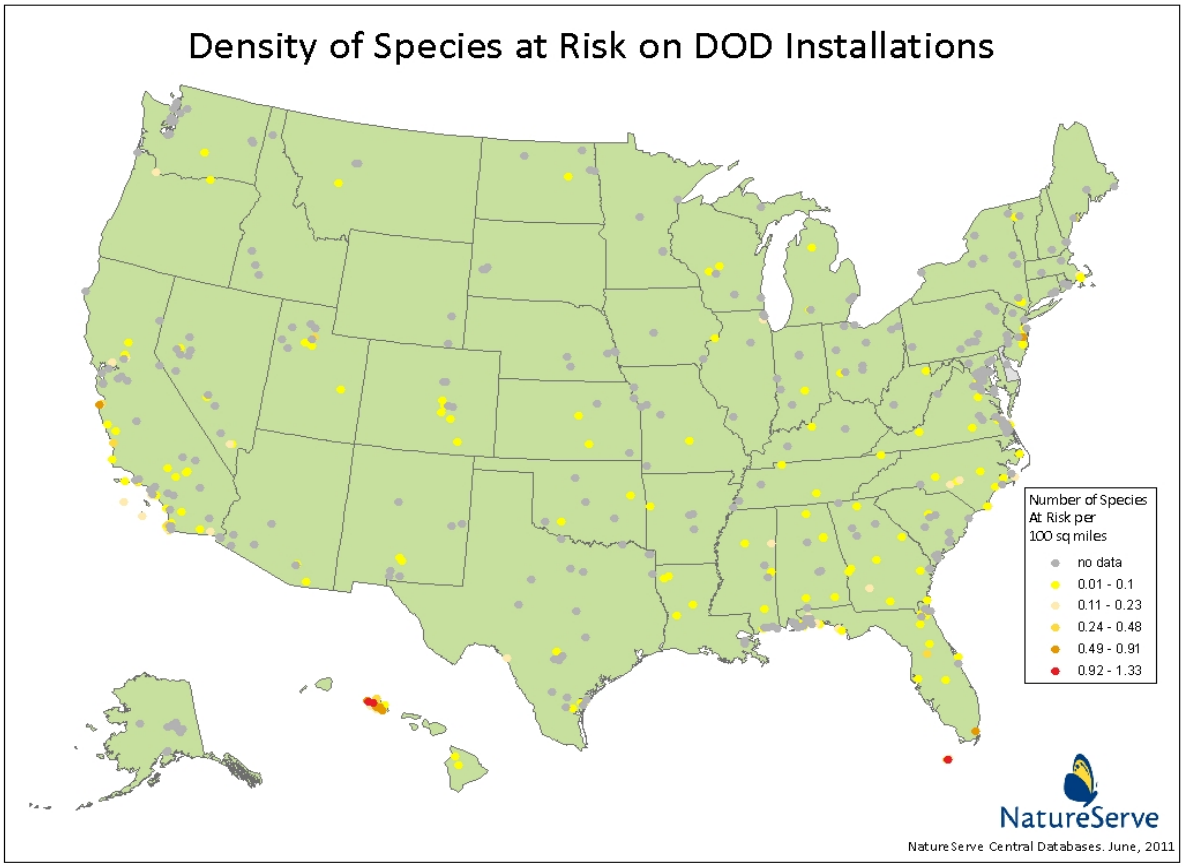
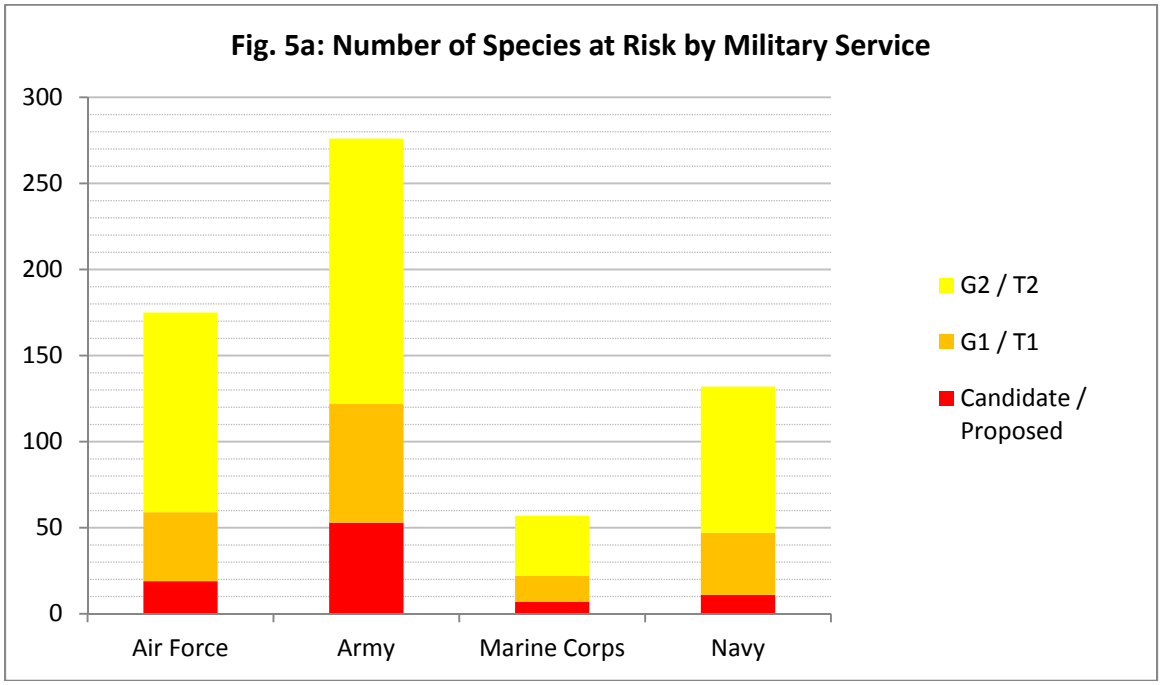
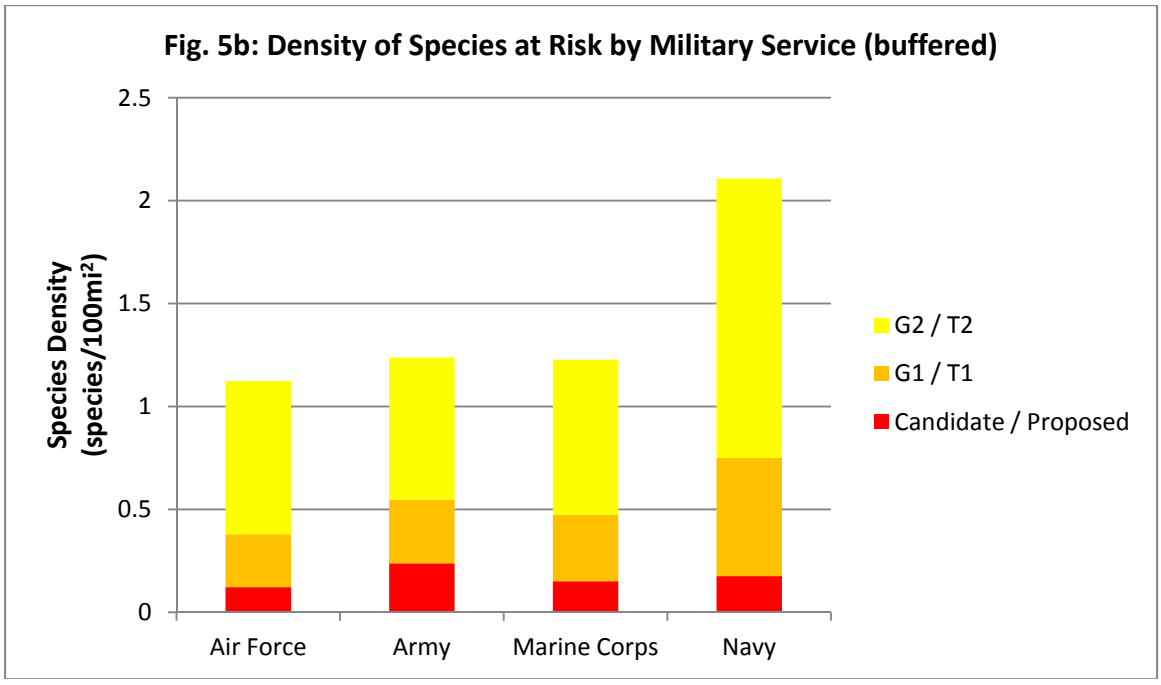


Figure 4b. Map depicting the density of at-risk species (no. species/100 square miles) occurring on DoD installations across the fifty U.S. States. The absence of data in any particular geographic area does not necessarily indicate that species at risk are not present. SOURCES: NatureServe 2011, Data.gov 2011.



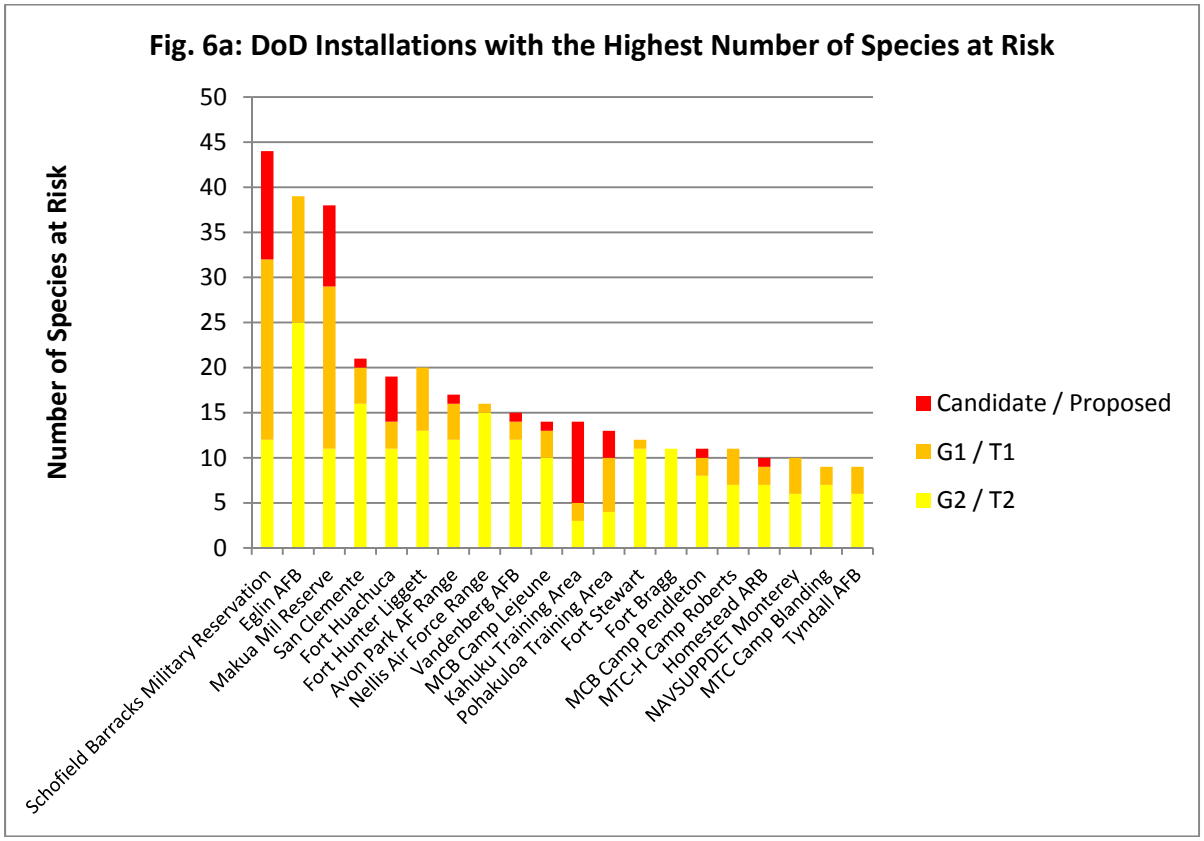
4.2 Assessment of Species at Risk by Military Service





4.3 Assessment of Species at Risk on Installations

4.3.1 Installation Highlights



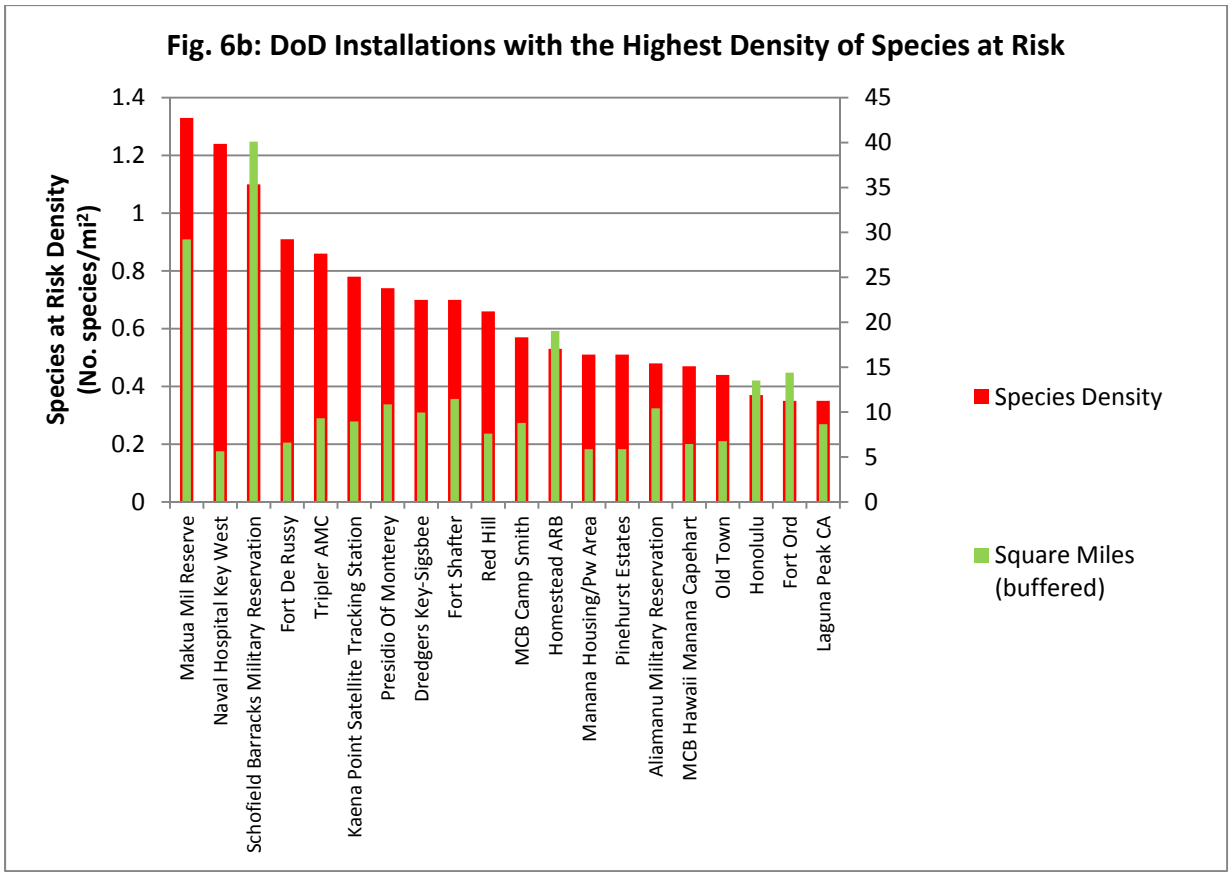
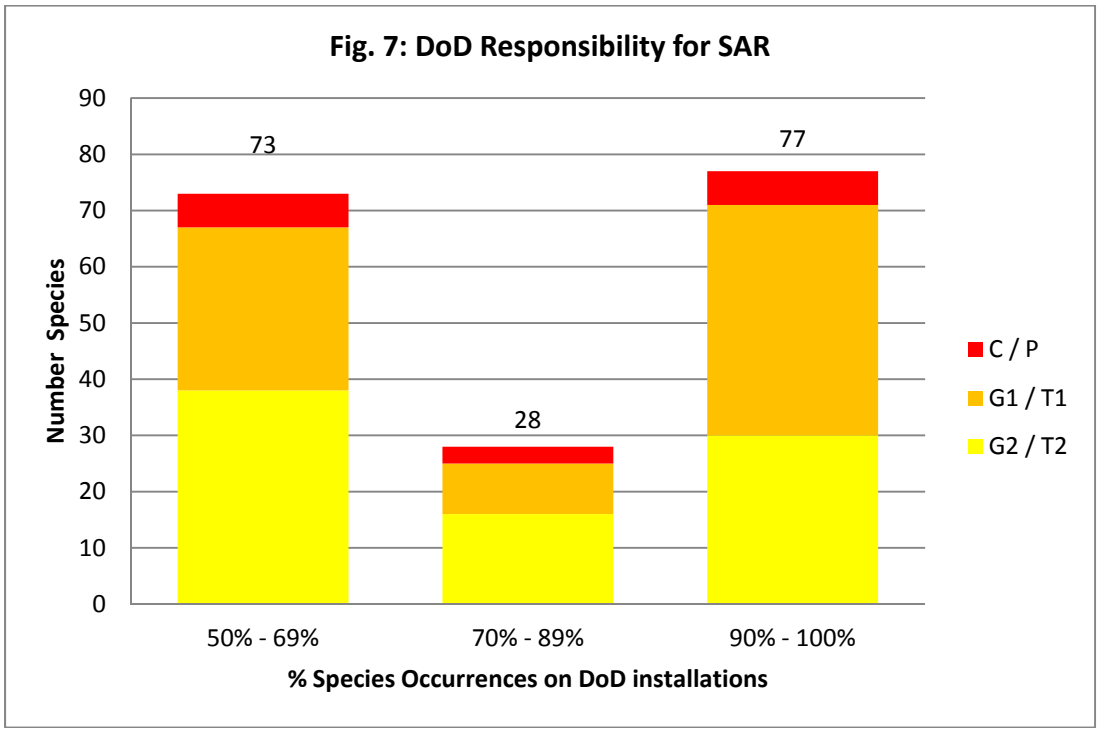


Fig. 6b: DoD Installations with the Highest Density of Species at Risk
Species at Risk Density (No. species/mi²)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
45
40
35
30
25
20
15
10
5
0
Makua Mil Reserve
Naval Hospital Key West
Schofield Barracks Military Reservation
Fort De Russy
Tripler AMC
Kaena Point Satellite Tracking Station
Presidio Of Monterey
Dredgers Key-Sigsbee
Fort Shafter
Red Hill
MCB Camp Smith
Homestead ARB
Manana Housing/Pw Area
Pinehurst Estates
Aliamanu Military Reservation
MCB Hawaii Manana Capehart
Old Town
Honolulu
Fort Ord
Laguna Peak CA
Species Density
Square Miles (buffered)

4.3.2 Species Restricted to DoD Installations

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



5.0 Appendices

5.1 Metadata

Appendix 5.1a. Data Use Suggestions and Guidelines..... 17
Appendix 5.1b. NatureServe Data Completeness, Quality, and Currentness 17
Appendix 5.1c. Data Exchange Cycle and Data Upload 20
Appendix 5.1d. United States Endangered Species Act Status..... 21
Appendix 5.1e. NatureServe Conservation Status Ranks 26
Appendix 5.1f. Rounded Global Conservation Status Ranks 26
Appendix 5.1g. Standard Global Taxonomic Sources 32
Appendix 5.1h. Supplemental State-Specific Documentation..... 45

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. 2011. 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 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://endangered.fws.gov/) and U.S. National Marine Fisheries Service (NMFS) (http://www.nmfs.noaa.gov/prot_res/overview/es.html). 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

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**
value (date)	Basic value	The taxon is named in the Federal Register and has one status.
Value, Value(date)	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.
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.
Value, Value	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.
PS:*Value*	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 populations) does not have an individual entry in NatureServe data. Information

		about the listed entity can be found in reports for the associated species.

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	**Presumed Extinct** (species)— Not located despite intensive searches and virtually no likelihood of rediscovery. **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.
GH	**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]
G1	**Critically Imperiled**—At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors.
G2	**Imperiled**—At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors.
G3	**Vulnerable**—At moderate risk of extinction or elimination due to a restricted range, relatively few populations, recent and widespread declines, or other factors.
G4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5	**Secure**—Common; widespread and abundant.

[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.

Infraspecific Taxon Conservation Status Ranks

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

Rank	Definition
T#	**Infraspecific Taxon** (trinomial)—The status of infraspecific 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 infraspecific 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]
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.

[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 Qualifiers[4]

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 Anthocerotophya 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 (October 2004)

I. Higher Taxonomy

Phyla and Subphyla:

- Integrated Taxonomic Information System. Integrated Taxonomic Information System: Biological Names. Available online at: http://www.itis.usda.gov/itis/status.html.
- 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.

II. Phylum Craniata (Vertebrates)

Class Mammalia (Mammals)

- American Society of Mammalogists. 1969-2004. Mammalian species. Cumulative index available online: http://www.science.smith.edu/departments/biology/vhayssen/page4.html [ASM publishes 25-30 species accounts each year; each summarizes the current understanding of a species' biology.]

- 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. Occasional Papers, Museum of Texas Tech University (229):1-23. [Used for North American common names and for updates of scientific names based on information published after Wilson and Reeder (1993)].
- 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.]
- 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. 1993. Mammal species of the world: a taxonomic and geographic reference. Second edition. Smithsonian Institution, Washington, D.C. Available online at: http://www.nmn h.si.edu/msw/.

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/aou/birdlist.html
- Cornell Lab of Ornithology. The Birds of North American Online. Available at: http://bna.birds.cornell.edu/BNA/

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

- Collins, J. T., and T. W. Taggart. 2002. Standard common and current scientific names for North American amphibians, turtles, reptiles, and crocodilians. Fifth edition. The Center for North American Herpetology, Lawrence, Kansas. iv + 44 pp.
- Crother, B. I., 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
- 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, W. F., and R. L. Burke. 1989. Crocodilian, tuatara, and turtle species of the world. Association of Systematics Collections. Available online at: http://www.flmnh.ufl.edu/natsci/herpetology/turtcroclist/.
- 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., and T. W. Taggart. 2002. Standard common and current scientific names for North American amphibians, turtles, reptiles & crocodilians. Fifth edition. The Center for North American Herpetology, Lawrence, Kansas. iv + 44 pp.
- Crother, B. I., J. Boundy, J. A. Campbell, K. de Queiroz, D. R. Frost, R. Highton, J. B. Iverson, P. A. Meylan, T. W. Reeder, M. E. Seidel, J. W. Sites, Jr., T. W. Taggart, S. G. Tilley, and D. B. Wake (editor). 20002008. 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 No. 29. Update: Crother et al., 2003, Herpetological Review 34:196-20337:1-84.
- Duellman, W. E. 1993. Amphibian species of the world: additions and corrections. University of Kansas Museum of Natural History, Special. Publication No. 21.
- Frost, Darrel R. 20042008. Amphibian Species of the World: an Online Reference. Version 3.05.2 (22 August, 200415 July 2008). Electronic Database accessible at http://research.amnh.org/herpetology/amphibia/index.html. American Museum of Natural History, New York.
- Petranka, 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.)
- Stebbins, R. C. 2003. A field guide to western reptiles and amphibians. Third edition. Houghton Mifflin Company, Boston.

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

- Eschmeyer, W. N., editor. Catalog of fishes. California Academy of Sciences, San Francisco. Online version. http://www.calacademy.org/research/ichthyology/catalog/
- 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. 2006. Fishes of the world. Fourth edition. John Wiley and Sons, Inc., Hoboken, New Jersey. xix + 601 pp. [Used for higher taxonomy]
- 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.

III. Freshwater Invertebrates

General

- Smith, D. G. 2001. Pennak's freshwater invertebrates of the United States. Fourth edition. John Wiley and Sons, Inc., New York.
- Thorp, J. H. and A. P. Covich (eds.). 2001. Ecology and classification of North American freshwater invertebrates. Second edition. Academic Press, California.

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.
- 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.
- Hawaii Biological Survey Web Site. 9 April 2002. Native snail list. Available: http://www.bishop.hawaii.org/bishop/HBS/hbs1.html

- Hawaii Biological Survey Web Site. 22 January 1997. Alien snail list. Available: http://www.bishop.hawaii.org/bishop/HBS/hbs1.html
- 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/index.htm
- 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.Williams, A. B., L. G. Abele, D. L. Felder, H. H. Hobbs, R. B. Manning, P. A. McLaughlin, and I. P. Farfante. 1989. Common and scientific names of aquatic invertebrates from the United States and Canada: decapod crustaceans. American Fisheries Society Special Publication 17: 1-77.

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 26:182-192.
- 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. 2002. The world spider catalog, Version 2.5. The American Museum of Natural History. Online. Available: http://research.amnh.org/entomology/spiders/catalog81-87/index.html

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.). 1996-97. *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/nomina.htm

VI. Order Coleoptera, Family Cicindelidae (Tiger Beetles)

- 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]
- 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., T. G. Barraclough, and A. P. Vogler. 1997. Distributional maps for North American species of tiger beetles (Coleoptera: Cicindelidae). Cicindela 29: 33-40.
- 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.

VII. Order Ephemeroptera (Mayflies)

- Purdue University Department of Entomology (W.P. McCafferty ed.) 1995. Last updated 9 July 2002. Mayfly Central- The Mayflies of North America. Online. Available: http://www.entm.purdue.edu/entomology/research/mayfly/Contents.html.

VIII. 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.

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

- Integrated Taxonomic Information System (ITIS). 2007. World Bee Checklist Project (version 13-Dec-2007). Integrated Taxonomic Information System: Biological Names. Online. Available: http://www.itis.gov
- Michener, C. D. 2000. The bees of the Worldworld. 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

X. 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.

XI. Order Lepidoptera (except two Superfamilies listed below [butterflies and skippers] and certain sub-groups listed below):

- 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.

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

- Cassie, B., J. Glassberg, P. Opler, R. Robbins, and G. Tudor. 1995. North American Butterfly Association (NABA) checklist and English names of North American butterflies. North American Butterfly Association, Morristown, NJ. 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.]
- Ferris, C. D., editor. 1989. Supplement to: A catalogue/checklist of the butterflies of America north of Mexico. The Lepidopterists' Society Memoir No. 3.
- Layberry, R. A., P. W. Hall, and J. D. Lafontaine. 1998. The butterflies of Canada. University of Toronto Press, Toronto.
- Miller, L. D., and F. M. Brown. 1981. A catalogue/checklist of the butterflies of America north of Mexico. The Lepidopterists' Society Memoir No. 2.
- 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]
- Opler, P. A., and A. B. Wright. 1999. Western butterflies. Houghton Mifflin Co., Boston, MA. [Used for English common names. This list mostly follows Cassie *et al*.]
- Pelham, J. P. 2008. A catalogue of the butterflies of the United States and Canada with a complete bibliography of the descriptive and systematic literature. The Journal of Research on the Lepidoptera. Volume 40. 658 pp.

Order Lepidoptera, Families Saturniidae (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.
- Smith, M. J. 1993. Moths of western North America: 2. Distribution of Sphingidae of western North America. Contributions of the C. P. Gillette Insect Biodiversity Museum, Department of Entomology, Colorado State University, Fort Collins.
- Tuskes, P. M., J. P. Tuttle, and M. M. Collins. 1996. The wild silk moths of North America. Cornell University Press, Ithaca, NY.
- Tuttle, J. P. 2007. The hawk moths of North America: A natural history study of the Sphingidae of the United States and Canada. The Wedge Entomological Research Foundation, Washington, D. C. 253 pp. +23 plates.

Order, Lepidoptera, Family Lymantriidae (Tussock Moths in part)

- Ferguson, D.C. 1978. The moths of America North of Mexico. Fascicle 22.2: Noctuoidea, Lymantriidae. Curwen Press, London

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

- Ferguson, D. C. 1996. Checklist of the Arctiidae of the United States and Canada. Systematics Entomology Laboratory, U.S.D.A., unpublished manuscript, Washington D.C. 16 pp.
- 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.
- Forbes, W. T. M. 1960. Lepidoptera of New York and Neighboring States, Noctuidae, Part IV. Memoir 371. Cornell Agricultural Experiment Station, Ithaca, New York. 188 pp.
- Schmidt, B.C. and P.A. Opler. 2008. Revised checklist of the tiger moths of the Continental United States and Canada. Zootaxa 1677:1-23.

Order Lepidoptera, Family Noctuidae, Genus *Catocala* (Underwing Moths)

- Gall, L. F. 1995. Unpublished database containing county level data for the North American species of *Catocala*. Entomology Division, Peabody Museum of Natural History, Yale University, New Haven, CT 06520-8118, USA.

- Gall, L. F. and D.C. Hawks. 1990. Systematics of moths in the genus Catocala (Lepidoptera, Noctuidae). I. Type material in the Strecker collection, with lectotype designations. Fieldiana, Zoology New Series no. 59, Publication # 1414 Field Museum of Natural History. 16 pp.
- Gall, L. F. and D.C. Hawks. 2002. Systematics of moths in the genus Catocala (Lepidoptera, Noctuidae). III. The types of William H. Edwards, Augustus R. Grote, and Achille Gunenee, with lectotype designations. Journal of the Lepidopterists' Society 56(4):234-264.

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

- Eric L. Quinter

Order Lepidoptera, Family Noctuidae, general.

- Fibiger, M. and J. D. Lafontaine. 2005. A review of the higher classification of the Noctuoidea (Lepidoptera) with special reference to the Holarctic fauna. Esperiana Buchreihe zur Entomologie 11: 7-690.
- Forbes, W. T.M. F,. 1954. The Lepidoptera of New York and neighboring states, part III, Noctuidae. Cornell University Agricultural Experiment Station, Ithaca, NY. Mem. 329. [no longer useful for genera but still very useful for species concepts and circumscriptions and more accurate than 1983 Checklist for species in some genera]
- Lafontaine, J. D. 1987. Noctuoidea, Noctuidae (Part): Fascicle 27.2: Noctuinae (Part-Euxoa). The Moths of America North of Mexico (Lepidoptera). E. W. Classey Ltd. and R. B. D. Publications, London, England. 237 pp.
- LaFontaine, J. D. 1998. Noctuidea, Noctuidae (part-Noctuini). In Dominick, R.B. et al. The Moths of America North of Mexico. Fascicle 27.3. The Wedge Entomological Research Foundation. 348 pp.
- Lafontaine, J.D. 2004. Moths of America North of Mexico, Fascicle 27.1 Noctuoidea, Noctuidae (Noctuinae part: Agrotini). 385 pp., 75 plates.
- Lafontaine, J.D. and Fibiger, M. 2006. Revised higher classification of the Noctuoidea (Lepidoptera). Canadian Entomologist 138: 610–635.
- Lafontaine, J. D. and R. W. Poole. 1991. Noctuoidea, Noctuidae: Fascicle 25.1: Plusiinae. The Moths of America North of Mexico (Lepidoptera). E. W. Classey Ltd. and R. B. D. Publications, London, England. 182 pp.
- Poole , R. W., 1989. Lepidopterorum Catalogus (new series) Fascicle 118: Noctuidae. E.J. Brill, Leiden, The Netherlands. 1314 pp in 3 volumes.
- Poole , R. W. 1994. Noctuoidea, Noctuidae: Fascicle 26.1: Cucullinae, Stiriinae, Psaphidinae (Part). The Moths of America North of Mexico (Lepidoptera). E. W. Classey Ltd. and R. B. D. Publications, London, England. 250 pp.

XII. Order Odonata (Dragonflies and Damselflies)

- Abbott, J.C. 2007. January 28-last update. OdonataCentral. The University of Texas at Austin, School of Biological Sciences, Section of Integrative Biology. Online. Available: http://odonatacentral.bfl.utexas.edu/
- Kondratieff, B.C. (coordinator). 2000. Last updated 12 December 2003. Dragonflies and Damselflies (Odonata) of the United States. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Available: http://www.npwrc.usgs.gov/resource/distr/insects/dfly/index.htm
- Needham, J. G., M. J. Westfall, Jr. and M. L. May. 2000. Dragonflies of North America. Scientific Publishers, Gainesville, Florida.
- Nishida, G.M., editor. 2002. Last updated - 9 April 2002. Bishop Museum - Hawaiian arthropod checklist. Online. Available: http://www2.bishopmuseum.org/HBS/checklist/query.asp?grp=Arthropod
- Paulson, D. R., and S. W. Dunkle. 1999. A checklist of North American Odonata. Slater Museum of Natural History Occasional Papers 56. Available and updated online at: http://www.ups.edu/x7015.xml
- Westfall, M. J., Jr., and M. L. May. 19962006. Damselflies of North America, revised edition. Scientific Publishers, Gainesville, Florida. 503 pp.

XIII. Order Orthoptera (Grasshoppers, Katydids, 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.Naskrecki, P., and D. Otte. 9 October 1999. Orthoptera species file online. University of Connecticut. Available: http://viceroy.eeb.uconn.edu/Orthoptera
- Otte, D. 1981. The North American Grasshoppers. Volume 1. Acrididae. Gomphocerinae and Acridinae. Harvard University Press, Cambridge, MA.
- Otte, D. 1984. The North American Grasshoppers. Volume 2. Oedipodinae. Harvard University Press, Cambridge, MA.
- Otte, D. 1994-1995. Orthoptera Species File. Volumes 2-5 (Grasshoppers: Acridomorpha). The Orthopterists' Society and the Academy of Natural Sciences of Philadelphia.
- Otte, Daniel. Department of Entomology, The Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103.

XIV. Order Plecoptera (Stoneflies)

- Stark, B.P. 1996. Last updated 16 February 2001. North American Stonefly List. Online. Available: http://www.mc.edu/campus/users/stark/Sfly0102.htm

- Stark, B. P. and B. J. Armitage (eds.). 2000. Stoneflies (Plecoptera) of eastern North America. Volume 1. Pteronarcyidae, Peltoperlidae, and Taeniopterygidae. Bulletin of the Ohio Biological Survey New Series 14:1-99.
- Stark, B.P. and B.J. Armitage (eds.). Stoneflies (Plecoptera) of Eastern North America. Volume II. Chloroperlidae, Perlidae, and Perlodidae (Perlodinae). Ohio Biological Survey Bulletin New Series 14:1-19

XV. 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/]
- Morse, J. C. 2004. Trichoptera World Checklist online. Available at: http://entweb.clemson.edu/database/tricopt/

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	Endangered	Endangered. The Alaska state endangered species list is a subset of the Federal Threatened and Endangered list.	Unknown
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

Program	Subnational Protection Status	Definition	Legal Status
AL	CHM	Commercially Harvestable Mussel - Legal to Take for Commercial Purposes (Managed harvest regulations): State regulations (Regulations 220-2-.48, 220-2-.49, 220-2-.103, 220-2-.104, 220-2-.106, 220-2-.50, 220-2-.51, 220-2-.52, and 220-2-.53 of the Alabama Regulations on Game, Fish, and Fur Bearing Animals) limit where, when, and how harvest may occur.	yes
AL	CNGF	Commercial or Non-Game Fish (Managed fishing regulations)	yes
AL	FB	Fur-Bearing Animal (Managed trapping regulations)	yes
AL	GA	Game Animal (Managed hunting regulations)	yes
AL	GANOS	Game Animal - No Open Season (No hunting allowed): Species designated a game animal by Regulation 220-2-.07 of the Alabama Regulations on Game, Fish, and Fur Bearing Animals, but for which there is no open season.	yes
AL	GASP	Game Animal - by Special Permit Only (Managed hunting regulations)	yes
AL	GB	Game Bird (Managed hunting regulations)	yes
AL	GBNOS	Game Bird - No Open Season (No hunting allowed): Species designated a game bird by Regulation 220-2-.04 of the Alabama Regulations on Game, Fish, and Fur Bearing Animals, but for which there is no open season.	yes
AL	GF	Game Fish (Managed fishing regulations)	yes
AL	PSM	Partial Status: Mussel species partially protected by the Alabama Regulations on Game, Fish, and Fur Bearing Animals. Regulation 220-2-.104 prohibits the harvest of this species for commercial purposes. Regulation 220-2-.52 prohibits the taking of any freshwater mussel from certain waters.	yes
AL	PSNG	Partial Status Nongame: Species not included in the list of protected nongame animals (Regulation 220-2-.92(1)) but partially protected by other clauses of the Nongame Regulation which impose a limit on the number which can be possessed (Regulation 220-2-.92(2)) or size limits (Regulation 220-2-.92(3)).	yes
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	ER	Export Restricted: transport out of State prohibited (plants)	yes
AZ	HR	Harvest restricted: permits required to remove plant by-products (plants)	yes

Program	Subnational Protection Status	Definition	Legal Status
AZ	HS	Highly safeguarded: no collection allowed (plants)	yes
AZ	SA	Salvage Assessed: permits required to remove live trees	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	Candidate	A candidate for listing as Endangered or Threatened under the California Endangered Species Act	yes
CA	Delisted	Removed from the list of Endangered or Threatened species under the California Endangered Species Act	no
CA	DFG_FP-Fully Protected	The classification of Fully Protected was the State's initial effort to identify and provide additional protection to those animals that were rare or faced possible extinction. Lists were created for fish, amphibians and reptiles, birds and mammals. Most of the species on these lists have subsequently been listed under the state and/or federal endangered species acts; white-tailed kite, golden eagle, trumpeter swan, northern elephant seal and ring-tailed cat are the exceptions. The white-tailed kite and the golden eagle are tracked in the CNDDB; the trumpeter swan, northern elephant seal and ring-tailed cat are not. The Fish and Game Code sections dealing with Fully Protected species state that these species "....may not be taken or possessed at any time and no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected" species, although take may be authorized for necessary scientific research. In 2003 the code sections dealing with fully protected species were amended to allow the Department to authorize take resulting from recovery activities for state-listed species.	yes
CA	DFG_SSC-Species of Special Concern	A Species of Special Concern is a species, subspecies, or distinct population of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: 1) is extirpated from the State or, in the case of birds, in its primary seasonal or breeding role; 2) is listed under the Federal Endangered Species Act, but not the State Endangered Species Act; 3) meets the State definition of threatened or endangered but has not formally been listed; 4) is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for State threatened or endangered status; 5) has naturally small populations exhibiting high susceptibility to risk from any factor(s), that if realized, could lead to declines that would qualify it for State threatened or endangered status.	no

Program	Subnational Protection Status	Definition	Legal Status
CA	DFG_WL-Watch List	A new California Bird Species of Special Concern report was completed in 2008. A new category of "Taxa to Watch" was created in the new report. The birds on this Watch List are 1) not on the current Special Concern list but were on previous lists and they have not been state listed under the California Endangered Species Act; 2) were previously state or federally listed and now are on neither list; or 3) are on the list of "Fully Protected" species.	no
CA	Endangered	Listed as Endangered under the California Endangered Species Act	yes
CA	None	No status under the California Endangered Species Act	no
CA	Rare	The Native Plant Protection Act (NPPA) of 1977 (Fish and Game Code Section 1900-1913) directed the Department of Fish and Game (DFG) to carry out the Legislature's intent to "preserve, protect and enhance rare and endangered plants in this State." The NPPA gave the California Fish and Game Commission the power to designate native plants as "endangered" or "rare" and protected endangered and rare plants from take.The California Endangered Species Act of 1984 (Fish and Game Code Section 2050-2116) expanded upon the original NPPA and enhanced legal protection for plants, but the NPPA remains part of the Fish and Game Code. To align with Federal regulations, California Endangered Species Act (CESA) created the categories of "threatened" and "endangered" species. It converted all "rare" animals into the Act as threatened species, but did not do so for rare plants. Thus, there are three listing categories for plants in California: rare, threatened, and endangered.	yes
CA	Threatened	Listed as Threatened under the California Endangered Species Act	yes
CO	SC	Special Concern (animals)	No
CO	SE	State endangered; elements of native wildlife whose prospects for survival or recruitment within this state are in jeopardy.	Yes
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
CT	E	"Endangered species" means any native species documented by biological research and inventory to be in danger of extirpation throughout all or a significant portion of its range within the state and to have no more than five occurrences in the state, and any species determined to be an "endangered species" pursuant to the federal Endangered Species Act	yes
CT	SC	"Species of Special Concern" means any native plant species or any native nonharvested wildlife species documented by scientific research and inventory to have a naturally restricted range or habitat in the state, to be at a low population level, to be in such high demand by man that its unregulated taking would be detrimental to the conservation of its population or has been extirpated from the state	yes
CT	SC*	Historical or presumed extirpated. The protection for these fall under the "Species of Special Concern" definition.	yes

Program	Subnational Protection Status	Definition	Legal Status
CT	T	"Threatened species" means any native species documented by biological research and inventory to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range within the state and to have no more than nine occurrences in the state, and any species determined to be a "threatened species" pursuant to the federal Endangered Species act, except for such species determined to be endangered by the commissioner in accordance with section 4 of this act	yes
DE	E	Endangered Species (animals only)	yes
FL	F(XN)	ANIMALS: Federal listed as an experimental population in Florida	Yes
FL	FE	ANIMALS: Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service	Yes
FL	FT	ANIMALS: Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service	Yes
FL	FT(S/A)	ANIMALS: Federal Threatened due to similarity of appearance	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	N	ANIMALS & PLANTS: Not currently listed, nor currently being considered for listing.	No
FL	SSC	ANIMALS: Listed as Species of Special Concern by the FFWCC. 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	SSC*	ANIMALS: Indicates that a species has SSC status only in selected portions of its range in Florida. (SSC* for Pandion haliaetus (Osprey) indicates that this status applies in Monroe county only.)	Yes
FL	ST	ANIMALS: State population listed as Threatened by the FFWCC. 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: For Ursus americanus floridanus (Florida black bear) indicates that this status does not apply in Baker and Columbia counties and in the Apalachicola National Forest. For Neovison vison pop.1 (Southern mink, South Florida population) indicates that this status applies to the Everglades population only.)	Yes

Program	Subnational Protection Status	Definition	Legal Status
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	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
GA	U	Listed as unusual (and thus deserving of special consideration). Plants subject to commercial exploitation would have this status.	yes
IA	E	Endangered - any species of fish, plant life, or wildlife which is in danger of extinction throughout all or a significant part of its range. (Iowa Administrative Code definition)	YES
IA	S	Special Concern - any species about which problems of status or distribution are suspected, but not documented, and for which no special protection is afforded under this rule. (Iowa Administrative Code definition)	NO
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	E	Endangered - No person shall take or possess those species of wildlife classified as Protected Nongame, or Threatened or Endangered at any time or in any manner, except as provided in Sections 36-106(e), 36-401, and 36-1107, Idaho Code, by Commission rule, or IDAPA 13.01.10, 'Rules Governing the Importation, Possession, Release, Sale, or Salvage of Wildlife,' Subsection 100.06.b. Protected Nongame status is not intended to prevent unintentional take of these species, protection of personal health and/or safety, limit property and building management, or prevent management of animals to address public health concerns or agricultural damage. (7-12-10)	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
ID	G, E	Game, Endangered	yes
ID	G, T	Game, Threatened	yes
ID	P	Protected Nongame - No person shall take or possess those species of wildlife classified as Protected Nongame, or Threatened or Endangered at any time or in any manner, except as provided in Sections 36-106(e), 36-401, and 36-1107, Idaho Code, by Commission rule, or IDAPA 13.01.10, "Rules Governing the Importation, Possession, Release, Sale, or Salvage of Wildlife," Subsection 100.06.b. Protected Nongame status is not intended to prevent unintentional take of these species, protection of personal health and/or safety, limit property and building management, or prevent management of animals to address public health concerns or agricultural damage. (7-12-10)	yes

Program	Subnational Protection Status	Definition	Legal Status
ID	PR	Predatory - Those species of wildlife classified as Unprotected Wildlife and Predatory Wildlife may be taken in any amount, at any time, and in any manner not prohibited by state or federal law, by holders of the appropriate valid Idaho hunting, trapping, or combination hunting and fishing licenses, provided such taking is not in violation of state, county, or city laws, ordinances, or regulations. (7-1-93)"	unknown
ID	T	Threatened - No person shall take or possess those species of wildlife classified as Protected Nongame, or Threatened or Endangered at any time or in any manner, except as provided in Sections 36-106(e), 36-401, and 36-1107, Idaho Code, by Commission rule, or IDAPA 13.01.10, "Rules Governing the Importation, Possession, Release, Sale, or Salvage of Wildlife," Subsection 100.06.b. Protected Nongame status is not intended to prevent unintentional take of these species, protection of personal health and/or safety, limit property and building management, or prevent management of animals to address public health concerns or agricultural damage. (7-12-10)	yes
IL	LE	Listed Endangered (plants and animals)	yes
IL	LT	Listed Threatened (plants and animals)	yes
IL	RE	Removed from Endangered species list (plants and animals)	no
IL	RT	Removed from Threatened species list (plants and animals)	no
IL	W	watch list	no
IN	SE	State endangered, (legal protection for mammals, fish, birds, reptiles, amphibians, mussels)	Yes
IN	SG	State Significant. Applies to high quality natural communities.	No
IN	SR	State Rare. Plants and insects known to occur currently on from 11-20 sites.	No
IN	SRE	Previously extirpated from state, trying to re-introduce into IN (plants); not on list provided in 2005 data exchange, but there are two ESTs with this status. Same holds for 2006 exchange (cscott 1/8/2006)	No
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
IN	ST	State Threatened. Plants known to occur currently on from six to ten sites	No
IN	SX	State Extirpated. Any animal species that has been absent from Indiana as a naturally occurring breeding population for more than 15 years. Extirpated plant species are those believed to be originally native to Indiana but without any currently known po	Yes
IN	WL	Watch List. Plants and insects about which some problems of limited abundance or distribution in Indiana are known or suspected and should be closely monitored.	No
KS	C	Species in need of conservation (animals)	No
KS	E	Endangered (animals)	Yes
KS	T	Threatened (animals)	Yes

Program	Subnational Protection Status	Definition	Legal Status
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	H	Historic. A taxon documented from Kentucky but not observed reliably since 1990 but is not considered extinct or extirpated.	unknown
KY	N	None (plants and animals)	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
KY	X	Extinct / Extirpated. A taxon for which habitat loss has been pervasive and/or concerted efforts by knowledgeable biologists to collect or observe specimens within appropriate habitat have failed. Extinct: A taxon that no longer exists.	unknown
LA	Endangered	Taking or harassment of these species is a violation of state and federal laws.	YES
LA	Prohibited	Possession of these species is prohibited. No legal harvest or possession.	YES
LA	Resticted Harvest	There are restrictions regarding the taking and possession of these species.	YES
LA	Restricted Harvest	There are restrictions regarding the taking and possession of these species.	YES
LA	Threatened	Taking or harassment of these species is a violation of state and federal laws.	YES
LA	Threatened/Endangered	Taking or harassment of these species is a violation of state and federal laws.	YES
MA	- H	No legal protection status; Historic	no
MA	- WL	No legal protection status; An unofficial list of plants and animals of known or suspected conservation concern the MA NHESP is interested in tracking.	no
MA	- X	No legal protection status; Extirpated	no
MA	E	Endangered (legal protection)	yes
MA	SC	Special concern (legal protection)	yes
MA	T	Threatened (legal protection)	yes
MD	(I)	commercial fish species in need of conservation	yes
MD	E	Endangered (plants and animals)	yes
MD	E*	Endangered, limited area only (plants and animals)	yes
MD	I	In need of conservation (animals)	yes
MD	T	Threatened (plants and animals)	yes
MD	X	Extirpated (plants and animals, considered Endangered if rediscovered)	yes

Program	Subnational Protection Status	Definition	Legal Status
ME	E	Endangered (plants and animals)	Yes ANIMALS
ME	E(B)	Endangered, breeding population only (animals)	Yes
ME	EXT	Extirpated (animals)	No
ME	EXT(B)	Extirpated, breeding population only (animals)	No
ME	PE	Possibly Extirpated (plants); Proposed Endangered (animals)	No
ME	SC	Special Concern (plants and animals)	SOMETIMES ANMLS, NO PLNTS
ME	SC(B)	Special Concern, breeding population only (animals)	SOMETIMES ANIMALS
ME	T	Threatened (plants and animals)	Yes ANIMALS
ME	T(B)	Threatened, breeding population only (animals)	Yes
MI	E	Endangered (legally protected)	Yes
MI	SC	Special Concern (Rare or status uncertain; not legally protected)	No
MI	T	Threatened (legally protected)	Yes
MI	X	Presumed extirpated (Legally threatened if rediscovered)	Yes
MN	END	Endangered species: A plant or animal species that is threatened with extinction throughout all or a significant portion of its range in Minnesota.	yes
MN	NON	Non: A species with no legal status, but about which the Natural Heritage and Nongame Research Program is gathering data 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 or the species has been recently discovered in the state; the species is presumed to be extirpated from the state.	no
MN	SHL-END	Endangered - status is assigned at a higher taxonomic level.	yes
MN	SHL-NON	Non - status is assigned at a higher taxonomic level.	no
MN	SHL-SPC	Special Concern Species - status is assigned at a higher taxonomic level.	yes
MN	SHL-THR	Threatened - status is assigned at a higher taxonomic level.	yes
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.	yes
MN	THR	Threatened species: A plant or animal species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in Minnesota.	yes
MO	E	Endangered (plants and animals): Determined by the MO Department of Conservation under constitutional authority.	yes

Program	Subnational Protection Status	Definition	Legal Status
MS	LE	State protected listed endangered (animals)	yes
MS	Non-game species in need of management		yes
MT	PSOC	Potential Species of Concern are native taxa for which current, often limited, information suggests potential	no
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 or Potential 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. See the latest Species of Concern Reports for more detailed explanations and assessment criteria.	no
NC	E	Endangered	Yes
NC	E-SC	Endangered - Special Concern (This dual status is given to endangered species that are also sold under specific regulations.) [Plants only.]	Yes
NC	SC	Special Concern	Yes
NC	SR	Significantly Rare [Animals only.]	No
NC	SR-D	Significantly Rare - Disjunct (The species is disjunct to NC from a main range in a different part of the country or world.) [Plants only.]	No
NC	SR-G	Significantly Rare - Game Animal (Game animals cannot be assigned an official State protection status.) [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-O	Significantly Rare - Other (The range of the species is sporadic or cannot be described by the other Significantly Rare categories.) [Plants only.]	No
NC	SR-P	Significantly Rare - Peripheral (The species is at the periphery of its range in NC. These species are generally more common somewhere else in their ranges, occurring in North Carolina peripherally to their main ranges, mostly in habitats which are unusual in North Carolina.) [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

Program	Subnational Protection Status	Definition	Legal Status
NC	T-SC	Threatened - Special Concern (This dual status is given to threatened species that are also sold under specific regulations.) [Plants only.]	Yes
NC	W1	Watch Category 1: (plants) rare, but relatively secure; (animals) known to be declining	No
NC	W2	Watch Category 2: (plants) rare, but taxonomically questionable; (animals) rare to uncommon, but probably not in trouble	No
NC	W3	Watch Category 3: (plants) rare, but uncertain documentation; (animals) poorly known, perhaps needs listing in upcoming years	No
NC	W4	Watch Category 4: (plants) rare, but believed not native; (animals) reported from the state without adequate documentation	No
NC	W5	Watch Category 5: (animals) rare, with increasing threat to habitat	No
NC	W5A	Watch Category 5A: (plants) rare because of severe decline	No
NC	W5B	Watch Category 5B: (plants) exploited plants	No
NC	W6	Watch Category 6: (plants) regionally rare	No
NC	W7	Watch Category 7: (plants) rare and poorly known	No
ND	Level I	These are species that are in decline and presently receive little or no monetary support or conservation efforts. North Dakota Game and Fish Department has a clear obligation to use State Wildlife Grant (SWG) funding to implement conservation actions that directly benefit these species. Level I species are those having a: - high level of conservation priority because of declining status either here or across their range, or - high rate of occurrence in North Dakota, constituting the core of the species breeding range (i.e. "responsibility" species) but are at-risk range wide	Unknown
ND	Level II	"North Dakota Game and Fish Department will use SWG funding to implement conservation actions to benefit these species if SWG funding for Level I species is sufficient or conservation needs have been met. Level II species are those having a: - moderate level of conservation priority, or - high level of conservation priority but a substantial level of non-SWG funding is available to them"	Unknown
ND	Level III	These are North Dakota's species having a moderate level of conservation priority but are believed to be peripheral or non-breeding in North Dakota.	no
NE	E	Endangered (plants and animals). Some legal protection.	Yes
NE	NC	Nongame Species in Need of Conservation (this section of the Nebraska Administrative Code states the hunting regulations on species with this designation); taking of these species is regulated and/or prohibited depending on the species.	Yes
NE	T	Threatened (plants and animals). Some legal protection.	Yes
NH	E	Endangered (plants and animals) (legal protection)	Yes
NH	SC	Special Concern (wildlife). (no legal status, but recommendations provided w/ permit reviews)	No
NH	T	Threatened, as designated under state law (plants and animals) (legal protection)	Yes
NJ	D	declining - species which has exhibited a continued decline in population numbers over the years	no

Program	Subnational Protection Status	Definition	Legal Status
NJ	D/D	declining/declining (breeding / nonbreeding statuses)	no
NJ	D/S	declining/stable (breeding / nonbreeding statuses)	no
NJ	E	Endangered	yes
NJ	E/S	endangered/stable (breeding / nonbreeding statuses)	yes
NJ	E/SC	endangered/special concern (breeding / nonbreeding statuses)	yes
NJ	E/T	endangered/threatened (breeding / nonbreeding statuses)	yes
NJ	E/U	endangered/unknown (breeding / nonbreeding statuses)	yes
NJ	EX	extirpated	no
NJ	I	introduced - species not native to New Jersey, that could not have established itself here without the assistance of man	no
NJ	I/	introduced	no
NJ	INC	increasing - species whose population has exhibited a significant increase beyond the normal range of its cycle, over a long term period	no
NJ	INC/INC	increasing/increasing (breeding / nonbreeding statuses)	no
NJ	INC/S	increasing/stable (breeding / nonbreeding statuses)	no
NJ	N/A	not applicable (no status??)	no
NJ	NA	not applicable (no status??)	no
NJ	P	peripheral - species whose occurrence in New Jersey is at the extreme edge of its present natural range	no
NJ	P/S	peripheral/stable (breeding / nonbreeding statuses)	no
NJ	RP	Regional Priority	NO
NJ	S	stable - species whose population is not undergoing any long term increase/decrease within its natural cycle	no
NJ	S/S	stable/stable (breeding / nonbreeding statuses)	no
NJ	S/SC	stable/special concern (breeding / nonbreeding statuses)	yes
NJ	SC	Species of Special Concern	YES
NJ	SC/RP	special concern/regional priority (breeding / nonbreeding statuses)	no
NJ	SC/S	special concern/stable (breeding / nonbreeding statuses)	yes
NJ	SC/SC	special concern/special concern (breeding / nonbreeding statuses)	yes
NJ	T	Threatened	yes
NJ	T/S	threatened/stable (breeding / nonbreeding statuses)	yes
NJ	T/SC	threatened/special concern (breeding / nonbreeding statuses)	yes
NJ	T/T	threatened/threatened (breeding / nonbreeding statuses)	yes
NJ	U	Undetermined	NO
NJ	U/U	undetermined/undetermined - species about which there is not enough information available to determine the status	no
NJ	X/RP	extirpated/regional priority (breeding / nonbreeding statuses)	no

Program	Subnational Protection Status	Definition	Legal Status
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, commericial 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	R	Restricted - Restricted species means any listed large exotic cat species or subspecies. It is unlawful for any person to take, possess, transport, export, sell or offer for sale or ship any threatened or endangered species or subspecies, or any restricted species. New Mexico Administrative Code 19.33.1.	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
NN	1	Group 1: taxa that no longer occur on the Navajo Nation (plants and animals)	Unknown
NN	2	Group 2: taxa which is in danger of being eliminated from all or a significant portion of its range on the NN (plants and animals)	Unknown
NN	3	Group 3: taxa which is likely to become an endangered species, in the foreseeable future, throughout all or a significant portion of its range on the NN (plants and animals)	Unknown
NN	4	Group 4: taxa for which the Navajo Fish & Wildlife Dept does not currently have sufficient information to support their being in 2 or 3 but has reason to consider them (plants and animals, does not provide legal protection)	Unknown
NV	CE	Critically endangered - species threatened with extinction, whose survival requires assistance because of overexploitation, disease or other factors or because their habitat is threatened with destruction, drastic modification or severe curtailment. Listed in N.A.C. 527.010 and protected under N.R.S. 527.260-.300 (plants)	yes
NV	CE,CY	Both listed as Critically Endangered and Protected under state Cactus & Yucca Law (plants)	yes
NV	CY	Protected as a cactus, yucca, or Christmas tree (N.R.S. 527.060-.120) (plants)	yes
NV	WA	Noxious Weed, category A (N.A.C. 555.010)	Unknown
NV	WB	Noxious Weed, category B (N.A.C. 555.010)	Unknown

Program	Subnational Protection Status	Definition	Legal Status
NV	WC	Noxious Weed, category C (N.A.C. 555.010)	Unknown
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	GN	Game Species with no open season (animals): Defined as a Game species (other than birds) by New York State law, but there are no open seasons set and the species may not be hunted or taken at any time in New York. (legal protection)	Yes
NY	GS	Game Species with open season (animals): Defined as a Game species by New York State law, and there are open seasons set when the species may be legally hunted or trapped. (legal protection)	Yes
NY	P - L	Protected in law (animals): An animal protected by specific mention in New York State law; hunting or taking of the species is not legal at any time in New York. (legal protection)	Yes
NY	P - N	Protected, with no open season (animals): New York State regulations specifically do not set any open seasons, and possession and taking of the species is not permitted at any time in New York. (legal protection)	Yes
NY	PB	Protected Bird (animals): Defined as a Protected Bird by New York State law, and the species may not be hunted or taken at any time in New York. Includes birds also defined as a game species, but for which no open seasons are set.	Yes
NY	PB - GS	Protected Bird with Open Season (animals): Defined as a Protected Bird by New York State law and as a Game species; there are open seasons set when the species may be legally hunted or trapped. (legal protection)	Yes
NY	R	Rare (plants): A plant listed as Rare by New York State. 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
NY	U	Unlisted (plants and animals): Not listed or protected by New York State. (no legal protection)	No

Program	Subnational Protection Status	Definition	Legal Status
NY	V	Exploitably Vulnerable (plants): A plant listed as Exploitably Vulnerable (likely to become threatened in the near future if causal factors continue unchecked) by New York State. Removal or damage without the consent of the landowner is prohibited. (legal protection)	Yes
OH	A	Added Species (plants) - recently added to the rare plant inventory, not enough info to determine OH status	No
OH	E	Endangered (plants and animals)	Yes
OH	N	No Status (animals)	No
OH	O	Species is extinct	No
OH	P	Potentially Threatened (plants)	No
OH	SC	Special Concern (animals)	No
OH	SI	Special Interest (animals)	No
OH	T	Threatened (plants and animals)	Plants -Yes, Animals -No
OH	X	Presumed Extirpated (plants and animals)	No
OK	Category I	A native species with a presently stable or increasing population that current evidence indicates is especially vulnerable to extirpation because of limited range, low population or other factors.	no
OK	Category II	A species identified by technical experts as possibly threatened or vulnerable to extirpation but for which little, if any, evidence exists to document the population level, range or factors pertinent to its status.	no
OK	Endangered	An endangered species is a native species whose prospects of survival or recruitment within the state is in imminent jeopardy. This determination will be based primarily upon species status within Oklahoma.	yes
OK	Threatened	A threatened species is a native species that, although not presently in danger of extirpation, is likely to become endangered in the foreseeable future in the absence of special protection and management efforts.	yes
OR	C	Candidate. Taxa for which NOAA Fisheries or USFWS have sufficient information to support a proposal to list under the ESA, or which is a candidate for listing by the ODA under the OESA. No legal protection.	no
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
OR	LT	Listed Threatened. Taxa listed by the USFWS, NOAA Fisheries, ODA, or ODFW as Threatened.	yes

Program	Subnational Protection Status	Definition	Legal Status
OR	SC	CRITICAL - "Critical" sensitive species are those for which listing as threatened or endangered would be appropriate if immediate conservation actions were not taken. Some peripheral species which are at risk throughout their range and some disjunct populations (those that are geographically isolated from other populations) are also considered "Critical." No legal protection.	no
OR	SV	VULNERABLE - "Vulnerable" sensitive species are not in imminent danger of being listing as threatened or endangered, but could become "sensitive-critical," "threatened," or "endangered," with changes in populations, habitat or threats. No legal protection.	no
PA	N	None (No current legal status exists, but is under review for future listing) (animals and plants); PA: unofficial category: has no basis in any law	No
PA	PC	PA Candidate (fish, amphibians, reptiles & aquatic organisms): All fish, herptile, and aquatic organism species that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.	Yes
PA	PE	PA Endangered (animals and plants): Plant species which are in danger of extinction throughout most of their natural range within this Commonwealth, if critical habitat is not maintained or if the species is greatly exploited by man. This classification shall also include any populations of plant species that have been classified as Pennsylvania Extirpated, but which subsequently are found to exist in this Commonwealth. Animal species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1) species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpation from the Commonwealth; or 2) species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3) species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4) species determined to be "Endangered" pursuant to the Endangered Species Act of 1973, Public Law 93 205 (87 Stat. 884), as amended. All fish, herptile, and aquatic organism species declared by: 1) the Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission, Executive Director to be threatened with extinction and appear on the Pennsylvania Endangered Species List published by the Pennsylvania Bulletin.	Yes
PA	PR	PA Rare (plants) Plant species which are uncommon within this Commonwealth. All species of the native wild plants classified as Disjunct, Endemic, Limit of Range and Restricted are included within the Pennsylvania Rare classification.	Yes

Program	Subnational Protection Status	Definition	Legal Status
PA	PT	PA Threatened (animals and plants): Plant species which may become endangered throughout most or all of their natural range within this Commonwealth, if critical habitat is not maintained to prevent their future decline, or if the species is greatly exploited by man. Animal species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1) species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2) species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factors that have been identified and documented; or 3) species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4) species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered". All fish, herptile, and aquatic organism species declared by: 1) the Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2) have been declared by the Pennsylvania Fish Commission Executive Director to be in such small numbers throughout their range that they may become endangered if their environment worsens and appear on the Pennsylvania Threatened Species List published in the Pennsylvania Bulletin	Yes
PA	PV	PA Vulnerable (plants): Plant species which are in danger of population decline within Commonwealth because of their beauty, economic value, use as a cultivar, or other factors which indicate that persons may seek to remove these species from their native habitats.	Yes
PA	PX	PA Extirpated (plants): Plant species believed by the Department to be extinct within this Commonwealth. These plants may or may not be in existence outside the Commonwealth.	Yes
PA	TU	Tentatively Undetermined (plants): A classification of plant species which are believed to be in danger of population decline, but which cannot presently be included within another classification due to taxanomic uncertainties, limited evidence within historical records, or insufficient data.	Yes
RI	Concern	CONCERN: Native species not considered to be State Endangered or State Threatened at the present time, but are listed due to various factors of rarity and/or vulnerability. Species listed in this category may warrant endangered or threatened designation, but status information is presently not well known.	Unknown
RI	Concern/Protected	See definitions for CONCERN and PROTECTED	yes
RI	Endangered/Protected	See definitions for ENDANGERED and PROTECTED	yes

Program	Subnational Protection Status	Definition	Legal Status
RI	Not Listed		no
RI	Protected	Several reptiles are covered under regulations of the Rhode Island Division of Fish and Wildlife, which identifies several species as "protected", i.e., that possession without a permit is prohibited at all times.	yes
RI	State Endangered	ENDANGERED: Native species in imminent danger of extirpation from Rhode Island. These taxa may meet one or more of the following criteria: 1. Formerly considered by the U.S. Fish and Wildlife Service for Federal listing as endangered or threatened. 2. Known from an estimated 1-2 total populations in the state. 3. Apparently globally rare or threatened; estimated at 100 or fewer populations range-wide.	Unknown
RI	State Historical	HISTORICAL: Native species which have been documented for the state during the last 100 years, but which are currently unknown to occur. When known, the year of the last documented occurrence in Rhode Island is included.	Unknown
RI	State Historical (1939)	HISTORICAL: Native species which have been documented for the state during the last 100 years, but which are currently unknown to occur. When known, the year of the last documented occurrence in Rhode Island is included.	Unknown
RI	State Historical/Protected	See definitions for HISTORICAL and PROTECTED	yes
RI	State Threatened	THREATENED: Native species that are likely to become State Endangered in the future if current trends in habitat loss or other detrimental factors remain unchanged. In general, these taxa have 3-5 known or estimated populations and are especially vulnerable to habitat loss.	Unknown
RI	WL	Watch list (plants and animals)	no
SC	SE-Endangered	State Endangered (animals)	Yes
SC	ST-Threatened	State Threatened (animals)	Yes
SD	SE	State Endangered (plants and animals)	Yes
SD	ST	State Threatened (plants and animals)	Yes
TN	BLANK	Blank (for animals only) but tracked. The Tennessee Wildlife Resources Agency (TWRA) has not updated legal listings for animal species since 2001. The TN Natural Heritage Program has added many animal species to its track list since that time. Currently includes 22 vertebrate species and numerous invertebrates.	No

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
TN	E-P	Endangered / Possibly extirpated	Yes
TN	S	Special Concern (plants) - Any species or subspecies of plant that is uncommon in Tennessee, or has unique or highly specific habitat requirements or scientific value and therefore requires careful monitoring of its status.	Yes
TN	S-CE	Special Concern / Commercially Exploited	Yes
TN	S-P	Special Concern / Possibly extirpated	Yes
TN	S-PE	Special Concern / Proposed Endangered	Yes
TN	T	Threatened (plants and animals) - Any species or subspecies that is likely to become an endangered species within the foreseeable future	Yes
TN	T-CE	Threatened / Commercially Exploited	Yes
TX	E	Endangered species are those species which the Executive Director of the Texas Parks and Wildlife Department has named as being "threatened with statewide extinction". (http://www.tpwd.state.tx.us/nature/endang/regulations/texas/)	yes
TX	E,T	Endangered, Threatened (see definition for each)	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	CS	Species receiving special management under a Conservation Agreement in order to preclude the need for Federal listing.	no
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	SPC	Wildlife species of concern.	no
VA	LE	listed endangered (protected)	yes
VA	LT	listed threatened (protected)	yes
VA	SC	special concern (animals on a non-regulatory list)	no
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	C	Candidate Animal. Under review for listing. No legal protection.	no

Program	Subnational Protection Status	Definition	Legal Status
WA	C-Part	A portion of the taxon (subspecies or population) is a Candidate Animal. Under review for listing. (animals)	no
WA	E	Endangered. In danger of becoming extinct or extirpated from Washington. (animals and plants) No legal protection.	no
WA	E-Part	A portion of the taxon (subspecies or population) is Endangered. In danger of becoming extinct or extirpated from Washington. (animals)	no
WA	M	Monitor. Animal taxon of potential concern. No legal protection.	no
WA	M-Part	A portion of the taxon (subspecies or population) is Monitor, of potential concern.	no
WA	P1	Priority 1. Rare nonvascular plant but with insufficient information to assign another rank. No legal protection.	no
WA	P2	Priority 2. Nonvascular plant of concern but with insufficient information to assign another rank. No legal protection.	no
WA	R1	Review group 1. Of potential concern but needs more field work to assign another rank. (plants) No legal protection.	no
WA	R2	Review group 2. Of potential concern but with unresolved taxonomic questions. (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
WA	W	Watch. More abundant and/or less threatened than previously thought (plants) No legal protection.	no
WA	X	Possibly extinct or Extirpated from Washington. (animals and plants) No legal protection.	no
WI	END	State Endangered (plants and animals)	Y-Animals, N-Plants
WI	SC	Special concern - NOT designated as state endangered or threatened; main purpose of this category is to focus attention on certain species before they become endangered or threatened (plants and animals)	no
WI	SC/FL	Special concern - federally protected as endangered or threatened, but not so designated by WDNR	yes
WI	SC/H	Special concern - take regulated by establishment of open and closed seasons	yes
WI	SC/M	Special concern - fully protected by federal and state laws under the Migratory Bird Act	yes
WI	SC/N	Special concern - no laws regulating use, possession, or harvesting	no
WI	SC/P	Special concern - fully protected	yes
WI	THR	State Threatened (plants and animals)	Y-Animals, N-Plants

State-Specific Documentation and Data Issues

State-specific documentation and data issues are described in the following pages.

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. The following table contains known data gaps that state member programs have provided to NatureServe during the annual data exchange cycle. If no gaps are listed for a state, that means there were no gaps in a state's documentation that was provided to NatureServe during our most recent exchange that apply to the this analysis; 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.

State / Program	State / Program Specific Data Comments
Alabama Natural Heritage Program	
Arizona Heritage Data Management System	The Arizona Natural Heritage Program (NHP) is required to randomize, or "fuzz," all element occurrence (EO) data on private lands. The NHP is also required to fuzz EOs on public lands unless specific permission is received from those Federal Agencies managing the lands. For this analysis, the EOs were fuzzed to a 1 square mile grid before intersecting them with DoD installations. AZ HDMS has incomplete data for invertebrate animals; mostly tracks talus and spring snails. Fish data are for native species. The following geographic areas need additional inventory: Barry M. Goldwater Range (DoD Air Force), Yuma Proving Ground (DoD Army), Fort Huachuca (DoD Army), and Native American Lands. Because of data access constraints, NatureServe and the Arizona Natural Heritage Program cannot provide records for locations on Native American Tribal lands (other than those provided by the Navajo Nation Natural Heritage Program). Data from the tribal lands of Navajo Nation are tracked by the Navajo Nation Natural Heritage Program and are supplied separately for use in this project. This division of responsibility results in an apparent "hole" in the Arizona data set.
Arkansas Natural Heritage Program	The AR Natural Heritage Program probably has data for most imperiled (G1/T1 - G2/T2) species, but a comprehensive review has not been conducted. No known geographic data gaps.

State / Program	State / Program Specific Data Comments
Colorado Natural Heritage Program	CO NHP does not track a few plant species with questionable taxonomy. Does not track EOs in the following taxonomic classes: Cephalaspidomorphi, Elasmobranchiomorphi, Myxin. Data from the tribal lands of Navajo Nation are tracked by the Navajo Nation Natural Heritage Program and are supplied separately for use in this project. This division of responsibility results in an apparent "hole" in the Colorado data set.
Connecticut Natural Diversity Database	The data for Connecticut has been compiled from a variety of sources and thus includes the bias of each collector. There has been no comprehensive survey of the state for any of the taxonomic groups tracked by CT.
Delaware Natural Heritage Program	Data from Delaware is not currently available through NatureServe and is not included in this analysis. Please contact the Delaware Natural Heritage and Endangered Species Program directly (http://www.dnrec.delaware.gov/fw/NHESP/Pages/default.aspx; 302-739-9912) for information about Species at Risk in Delaware.
Florida Natural Areas Inventory	FNAI tracks the pondberry (Lindera melissifolia), only on a watch list. Some elements with questionable taxonomic status may be tracked under alternative names. Due to historical priorities and FNAI program resources, the invertebrate and fish (particularly marine and estuarine) components of biodiversity are less well represented than are the other element categories. The inventory includes truly statewide coverage of both public and private lands. Some areas which have not been as thoroughly surveyed or researched due to access restrictions include some corporate timberlands, primarily across north Florida, and several large (over 10,000 acres) private ranches, mostly in central Florida. Aquatic areas in general, and in particular marine and estuarine habitats, have not been as extensively surveyed due in part to the historical mission of FNAI and a lack of funding support for work in these areas.
Georgia Natural Heritage Program	
Idaho Conservation Data Center	The IDCDC tracks site-specific information on all federally listed Threatened, Endangered, Proposed, and Candidate species EXCEPT grizzly bear, woodland caribou, gray wolf, chinook salmon, steelhead, and bull trout. Grizzly bear and caribou are currently treated in the IDCDC database as polygonal recovery areas. Gray wolf polygons were based on wolf pack activity and on the movements of collared individuals. Chinook salmon and steelhead are currently treated in the IDCDC database as NOAA-defined Ecologically Significant Units. Bull trout are currently treated in the IDCDC database as USFWS-defined Core Areas. In general, there are no geographic gaps except for a core area of wilderness in eastern Idaho County and extreme northern Lemhi County which is inconveniently accessed and poorly surveyed for most species that might occur there.

State / Program	State / Program Specific Data Comments
Illinois Natural Heritage Database Program	Illinois only tracks species on Illinois' official list of Endangered and Threatened Species, which includes any federally listed species that occur in IL. There are no known major taxonomic data gaps for listed species. There are no known major geographic data gaps.
Indiana Natural Heritage Data Center	IN does not have EO data for non-vascular plants. There are no known geographic data gaps.
Kansas Natural Heritage Inventory	Kansas NHP does not have EO data for non-vascular plants. Large areas of private land throughout the state have never been surveyed. Many publicly-owned lands also have not been surveyed (Corps of Engineers, Kansas Dept. of Wildlife and Parks).
Kentucky Natural Heritage Program	Due to limited access, there are data gaps for much of Ft. Campbell military installation. The geographic region of the Tennessee Valley Authority (TVA) Heritage Program overlaps a portion of Kentucky. While known duplicate records have been removed from the project dataset, there is a possibility of an Element Occurrence (EO) being tracked by both the state and TVA programs. For more details, please see the comments for the TVA program below.
Louisiana Natural Heritage Program	LA does not track EOs for non-vascular plants. There are no known geographic gaps within the state.
Maine Natural Areas Program	
Maryland Natural Heritage Program	Data for non-vascular plants in minimal and mostly incomplete. Fish data are primarily for freshwater species.
Massachusetts Natural Heritage & Endangered Species Program	
Minnesota Natural Heritage & Nongame Research	The only federal or state listed species MN does not maintain EOs for is Gray Wolf. There are no known geographic data gaps.
Mississippi Natural Heritage Program	MS only tracks some non-vascular plants and invertebrate animals (mainly freshwater mussels). The geographic region of the Tennessee Valley Authority (TVA) Heritage Program overlaps a portion of Mississippi. While known duplicate records have been removed from the project dataset, there is a possibility of an Element Occurrence (EO) being tracked by both the state and TVA programs. For more details, please see the comments for the TVA program below.
Montana Natural Heritage Program	In general, data are state-wide. However, there are some areas of the state where data are sparse. There are several large parcels of tribal lands scattered across the state, and data are often not available from these areas. Also, some areas have high concentrations of private lands where access to land for data collection is restricted.

State / Program	State / Program Specific Data Comments
Navajo Natural Heritage Program	Data from the tribal lands of Navajo Nation are tracked by the Navajo Natural Heritage Program and include portions of Arizona, New Mexico, Utah, and Colorado. Data from the Navajo Nation Heritage Program includes selected information for Hopi lands.
Nebraska Natural Heritage Program	NE does not have data for non-vascular plants. No known geographic data gaps.
Nevada Natural Heritage Program	Bureau of Land Management lands sold to private developers in the Las Vegas Valley through the Southern Nevada Public Lands Management Act are not up to date. These are very small parcels (relatively speaking). In general there are no large gaps in our geographic data.
New Hampshire Natural Heritage Inventory	NH has limited data for non-vascular plants; primarily Sphagnum. No data for timber rattlesnakes (Crotalus horridus). Various large private timber companies' lands have not been inventoried in Coos County.
New Jersey Natural Heritage Program	NJ does not currently have the staff expertise to actively acquire data on some invertebrate species, particularly some insects. For fish – data are only for state and federally listed species. NJ has conducted very few if any statewide systematic surveys for animal species, so it is not possible to claim that the data for any of the species we track is complete without geographic gaps.
New Mexico Natural Heritage Program	Because of data access constraints, NM NHP has not provided records for: (1) Locations on Native American Tribal lands (other than those provided by the Navajo Nation Natural Heritage Program); (2) Locations on the lands of White Sands Missile Range and Fort Bliss Military Reservation. Data from the tribal lands of Navajo Nation are tracked by the Navajo Nation Natural Heritage Program and are included in these analyses. All other tribal areas in New Mexico are not represented in the NatureServe DoD-SPECIES AT RISK analyses.
New York Natural Heritage Program	NY NHP tracks EOs for: all imperiled (G1/T1 - G2/T2) species except for some SX, SNA and SNR species; all federally Threatened & Endangered Species except for some SX species, and for marine mammals and sea turtles which occur in NY offshore waters but do not have definable EOs (many used to be SZs), all state/province Threatened & Endangered Species except for some SX, SNA and SNR species. NY NHP has EOs for the following groups of invertebates: land snails, freshwater mussels, crayfish, mayflies, dragonflies and damselflies, beetles (tiger and burying), moths, butterflies and skippers.

State / Program	State / Program Specific Data Comments
North Carolina Natural Heritage Program	NC NHP does not track accidental species, and there are some imperiled G1/G2 species they do not track because: 1) all occurrences are protected 2) of taxomonic questions 3) of uncertain documentation 4) they are not native to the State 5) they are not yet rare enough, or 6) they are poorly known The North Carolina Natural Heritage Program conducts county-by-county inventories. The following counties (out of 100) have not had systematic inventories: Cherokee, Clay, Graham, Swain, Mitchell, Alexander, Wilkes, Caswell, Tyrrell, Dare, Union. The following counties (out of 100) have intentories in progress: Madison, Macon, Alleghany, Anson, Stanly, Robeson. The geographic region of the Tennessee Valley Authority (TVA) Heritage Program overlaps a portion of North Carolina. While known duplicate records have been removed from the project dataset, there is a possibility of an Element Occurrence (EO) being tracked by both the state and TVA programs. For more details, please see the comments for the TVA program below.
North Dakota Natural Heritage Inventory	ND Natural Heritage Inventory tracks all imperiled or federally threatened and endangered species listed for North Dakota. NDNHI also tracks species found on the NDNHI Species of Concern List and the ND Game and Fish Department's Species of Conservation Priority List. There are no specific taxonomic exclusions to mention. There are no known geographic gaps to mention.
Ohio Natural Heritage Database	OH does not "necessarily" track all G1/G2 species. No know geographic data gaps.
Oklahoma Natural Heritage Inventory	OK does not have data for non-vascular plants.
Oregon Natural Heritage Program	There are some species that have been assigned a G1/G2/T1/T2 by certain experts for which Oregon does not feel confident about its rank so we have placed it on our Review List. OR may or may not have EOs in Biotics for these, but they always keep and retain information in their manual files. OR does track marine mammals or those sea birds that do not actually land within the state (e.g. short-tailed albatross). The following lands need inventory:Warm Springs Reservation, Umatilla Reservation, Grande Ronde Reservation, Siletz Reservation, Burns Paiute Reservation, Coquille Reservation, Various other Indian Reservations, various private lands.
Pennsylvania Natural Diversity Inventory	
Rhode Island Natural Heritage Program	The RINHP currently does not track the following federal status species: Caretta caretta (Atlantic Loggerhead), Chelonia mydas mydas (Atlantic Green Turtle), and Lepidochelys kempii (Atlantic Ridley).

State / Program	State / Program Specific Data Comments
South Carolina Heritage Trust	Does not track all invertebrate or non-vascular plant imperiled (G1 – G2) species. A comprehensive survey of the South Carolina has never been done. The majority of the gaps fall on private lands, but there is some need for more complete surveys on public lands as well. These issues will be addressed as appropriate funding becomes available.
South Dakota Natural Heritage Data Base	SD does not have data for non-vascular plants. Private land (statewide) and tribal lands (west and central) are inadequately surveyed. No statewide inventories have been done due to lack of time and emphasis.
Tennessee Division of Natural Heritage	TN does not track data for fungi or lichens, with the exception of *Gymnoderma lineare* which is federally listed. Geographic gaps exist in the dataset for two of the national parks located in Tennessee. While some older data are mapped for these Parks, the Division of Natural Areas is aware of more recent observational data that the Park Service has not released because of data sensitivity. These parks are: 1. Big South Fork National River and Recreation Area located on the northern portion of the Cumberland Plateau in Tennessee, encompassing 195 square miles. 2. Great Smoky Mountains National Park located in southeastern Tennessee, encompassing 800 square miles in Tennessee and North Carolina. The geographic region of the Tennessee Valley Authority (TVA) Heritage Program overlaps a portion of Tennessee state. While known duplicate records have been removed from the project dataset, there is a possibility of an Element Occurrence (EO) being tracked by both the state and TVA programs. For more details, please see the comments for the TVA program below.
Tennessee Valley Authority (TVA) Regional Natural Heritage	The TVA Heritage Program's geographic region overlaps portions of the following states: Tennessee, Kentucky, Virginia, North Carolina, Georgia, Alabama, and Mississippi. This creates the possibility of a duplicative Element Occurrence (EO) being tracked by both a state Natural Heritage Program (NHP) and the TVA program. This duplication could result in a slightly inflated count of numbers of occurrences for some species, however, there is no impact on the Species at Risk installation-specific species lists and the species-level summary results.
Texas Conservation Data Center	No data for non-vascular plants. There are extensive areas of privately owned land that have not been surveyed.

State / Program	State / Program Specific Data Comments
Utah Natural Heritage Program	Because of data access constraints, the Utah Natural Heritage Program cannot provide records to NatureServe for locations on Native American Tribal lands (other than those provided by the Navajo Nation Natural Heritage Program). Therefore, this information was not included in the NatureServe DoD-SPECIES AT RISK project analyses Data from the tribal lands of Navajo Nation are tracked by the Navajo Nation Natural Heritage Program and are supplied separately. This division of responsibility results in an apparent "hole" in the Utah data set.
Virginia Division of Natural Heritage	The geographic region of the Tennessee Valley Authority (TVA) Heritage Program overlaps a portion of Virginia. While known duplicate records have been removed from the project dataset, there is a possibility of an Element Occurrence (EO) being tracked by both the state and TVA programs. For more details, please see the comments for the TVA program above.
Washington Natural Heritage Program	In the state of Washington, species locational data are maintained by two entities: The Washington Natural Heritage Program (WA-NHP) in the Department of Natural Resources maintains plant data which is provided to NatureServe. This program is a Natural Heritage Program and follows Natural Heritage data methodology. These data are included in the DoD-SPECIES AT RISK analyses. The Washington Department of Fish and Wildlife (WA-DFW) maintains animal location data. This program is not a Natural Heritage Program and does not follow Natural Heritage data methodology. Accordingly, animal data from WA-DFW were not included in this project. For DoD installations in Washington state, it is likely that there are additional animals that should be considered as SPECIES AT RISK but due to the above data limitation do not appear in the installation species lists and summary numbers.
West Virginia Natural Heritage Program	Data gaps include a large private land parcel in the western half of state that needs inventory (but this is difficult with privately owned lands).
Wisconsin Natural Heritage Program	WI maintains a list of non-vascular plant species but do not currently have any EOs. Inventories for Private Land and Tribal Land are incomplete.
Wyoming Natural Diversity Database	Data gaps to to lack of access for inventory: Wind River meridian (T034N-T044N and R094W-R106W) and various private lands.

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). 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.

Note: Data shown here is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.2_SAR on DoD installations_summary.xls**).

5.3 Species at Risk on DoD Installations: Comprehensive Information

Comprehensive information pertaining to species at risk occurring on DoD installations, including information about their conservation status, biology, habitat, and installations where they are found. Note that the species at risk that have at least half of their occurrences residing on DoD installations (as shown in Figure 7 in Results section 4.3.2) can be found by sorting on the "% of total EOs on base" column.

Note: Data shown here is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.3_SAR on DoD installations_comprehensive.xlsx**).

5.4 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 is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.4_DoD installations with SAR_summary.xls**).

5.5 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. See Appendix 5.3 (Species at Risk on DoD Installations – Comprehensive Information) for additional information about species biology and habitat requirements.

Note: Data shown here is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.5_DoD installations with SAR_comprehensive.xls**).

5.6 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. Data is not available for installations in Pennsylvania and Massachusetts because specific locational data was not available for those states.

Note: Data shown here is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.6_DoD installations_without_SAR.xls**).

5.7 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 is included in speadsheet format submitted electronically (filename: **10-247_Appendix 5.7_merged-or-excluded-installations.xls**).